RADIO-AUTOMOBILES-NEW INVENTIONS

Popular Science

FOUNDED MONTHLY 1872

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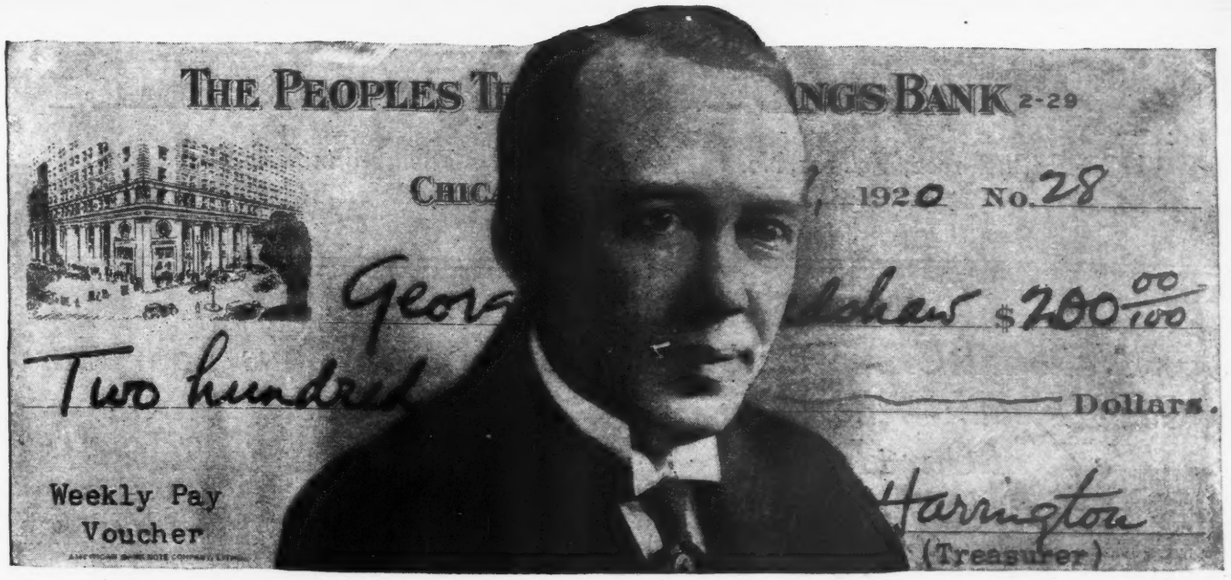

An Amazingly Easy Way to Earn $10,000 a Year

Let Me Show You How Free

TO the average man the $10,000 a year job is only a dream. Yet today there are a surprising number of men earning five figure salaries who were merely dreaming of them a short while ago. The secret of their success should prove a startling revelation to every ambitious man who has ever aspired to get into the $10,000 a year class.

There is nothing fundamentally "different" about the man whose salary runs into five figures. He is made of the same stuff as you and I. It is not necessary that he must enjoy the privilege of some influential connection or "pull." For example take J. P. Overstreet, of Denison, Texas. A few short years ago he was a police officer earning less than $1,000 a year. To-day his earnings are in excess of $1,000 a month—more than $12,000 a year. C. W. Campbell, Greensburg, Pa., was formerly a railroad employee on a small salary—last month his earnings were $1,562.

Why Salesmen Earn Such Big Pay

Just stop a moment and think over the successful men of your acquaintance. How many of them are connected with some form of selling? If you will study any business organization you will see that the big jobs go to the men who sell, for upon their efforts depend the profits a company makes. Without trained men to place a product on the market, the finest goods are worth no more than so much clay. Salesmen are the very nerve centers of a business. Is it any wonder that they earn big pay?

The man who starts working as a bookkeeper or clerk for $25.00 a week, never increases his value to the firm. Any advance in pay is merely a reward for length of service. At the end of ten years he is no more essential to the life of the organization than he was at the end of ten weeks. He is only a necessary liability—drawing his pay because somebody must be found to work at the unimportant, routine jobs. Once established in the rut, he becomes a cog in the machine—when he is worn out, he can be easily and cheaply replaced.

Why Don't You Get Into the Selling Field?

Mr. Overstreet, Mr. Campbell and the others whose letters you see on this page are all successful salesmen. They realized their ambitions by landing $10,000 jobs in an amazingly simple way, with the help and guidance of the National Salesmen's Training Association. Sometime—somewhere back in the past, each one of them read of this remarkable course of Salesmanship training and Employment Service just as you are reading of it to-day. Each one of them was dissatisfied with his earning capacity—as perhaps you are—and each one cast his lot with the N. S. T. A. To-day they are important factors in the business world—enjoying all the comforts and luxuries money can buy. And yet they are not exceptions, for there are thousands of N. S. T. A. trained salesmen who are making big money, as we will be only too glad to show you if you will mail the coupon.

We Train You and Help You Land a Job

The National Salesmen's Training Association is an organization of top-notch salesmen and sales managers formed for the express purpose of training men in the science of successful selling. You do not need to know the first thing about selling—for the N. S. T. A. trains you from the ground up—gives you a complete insight into selling methods—in your spare time without making it necessary to give up your present position until you are ready to begin actual selling.

In addition to this remarkably efficient course of training, the N. S. T. A. maintains a Free Employment Service to help its Members to jobs in the lines for which they are best suited. This in itself is of incalculable value for it allows the prospective salesman to make a complete survey of the selling field and to select the work which most appeals to him.

Read These Amazing Stories of Quick Success

Earned $524 in Two Weeks

I have never earned more than $60 a month. Last week I cleared $306 and this week $218. You have done wonders for me.—Geo. W. Kearns, Oklahoma City, Okla.

I Now Earn as High as $100 a Day

I took your course two years ago. Was earning $16 a week clerking. Am now selling many of the largest firms in the U. S. I have earned more than $100 in a day. You secured me my position. Our Sales Manager is a graduate of yours.—J. L. DeBonis, Chicago, Ill.

Earns $1,562 in Thirty Days

My earnings for the past thirty days are $1,562, and I won Second Prize in March although I only worked two weeks during that month.—C. W. Campbell, Greensburg, Pa.

Earned $1,800 in Six Weeks

As soon as I received a letter from you and your literature, I knew that I was on the right track and very soon after I applied for a position as a Salesman to one of the firms whom you informed me were in need of a Salesman and to whom you had recommended me. As soon as they received my application, which was by mail, they wired me to come for an appointment which I did, with the result being that I sold my service to them in about thirty minutes, took a territory in Illinois and Wisconsin and made a success of it from the very first week.

From that time on I have been what might be termed as a "high pressure" Salesman, selling lines where nine out of ten Order Takers would fail. I have sold goods in a highly successful manner in nine or ten States, both North and South. My earnings for March were over $1,000 and over $1,800 for the last six weeks, while last week my earnings were $356.00. I travel eleven months out of the year, working five days each week.

The N. S. T. A. dug me out of a rut where I was earning less than $1,000 a year and showed me how to make a success.—J. P. Overstreet, Denison, Texas.

Salesmen Are Needed—Now!

Get out of that rut! Work for yourself! Salesmanship is the biggest paid of all professions. Just because you have never sold anything is no sign that you can't. We have made Star Salesmen of men from all walks of life, with no previous selling experience. These men have jumped from small pay jobs to big selling positions and handsome incomes. The same training on which they founded their success is open to you. You can follow in their footsteps. Why don't you get in a class with men who make real money? Never before have the opportunities been greater. At least you cannot afford *not* to investigate the great field of selling and see what it offers *you*. It will only cost you a 2 cent stamp and the facts and proof you will receive will surprise you.

Free Book on Salesmanship

Just mail the coupon or write for our free illustrated Book. "Modern Salesmanship," which we will be glad to send without any obligation on your part. Let us prove to you that regardless of what you are doing now, you can quickly become a Star Salesman. Let us show you how you too can step into the ranks of these big money makers of business. See how easily you can learn this fascinating, big pay profession at home in your spare time. Learn what we have done for others and what we stand ready to do for you. Don't put it off until to-morrow—write us to-day. Every hour lost keeps you that much farther from success. Mail the coupon at once.

National Salesmen's Training Association

Dept. 15-S, Chicago, Ill., U. S. A.

National Salesmen's Training Association
Dept. 15-S, Chicago, Ill., U. S. A.

Please send me, without any obligation on my part, your free Book, "Modern Salesmanship," and full information about the N. S. T. A. system of Salesmanship training and Employment Service. Also a list showing lines of business with openings for salesmen.

Name .....

Street .....

City .....

Age ..... Occupation .....

POPULAR SCIENCE MONTHLY

NOVEMBER, 1922; Vol. 101, No. 5
25 cents a Copy; $2.50 a Year

Published in New York City at
225 West Thirty-ninth Street

Our National Crime against Good Health—the Way We Heat Our Homes!

THE fact that the air in your home during the winter is more arid than the atmosphere of any desert in the world may astonish you. But do you realize, also, that it involves an actual and grave menace to your health?

Read what noted experts have to say. You will learn that leading specialists consider the overheated dryness of the American home to be one of the chief causes of bad colds, sore throats, and serious winter infections of all kinds. Minor annoyances such as chapped hands are caused primarily by the dry heat indoors.

For Your Health's Sake

DO YOU know that soon after steam heat is turned on in apartments and offices, statistics show that illness takes a sudden jump?

There is probably no single convenience of modern homes that is so outright a menace to general health as the much-vaunted central heating system which Europe envies America!

AMAZING facts about heating arrangements, humidity, and health discovered by engineers and physicians, but ignored by the general public, are revealed in an eye-opening article in the next issue of POPULAR SCIENCE MONTHLY. This article is of vital importance to all your family's welfare.

A Whole Year for $2.50

MAKE sure of having POPULAR SCIENCE MONTHLY come to you regularly for the next year. You want to keep up with the marvelous new discoveries of science. Every issue will contain practical suggestions worth more than the subscription price. Send $2.50 for one year's subscription.

Uncle Sam Says Your Car Is Wasting 30% in Gas—Learn How to Save It!

GOVERNMENT engineers declare the average motorist wastes from 20 to 30 per cent of gasoline, just through faulty carburetor adjustment.

In the next issue of POPULAR SCIENCE MONTHLY are described the extraordinary results of recent experiments by the United States Bureau of Mines, which show that for lack of a simple device to switch the average carburetor instantly into various adjustments for hill climbing, starting, straight running, weather changes, etc., about one third of the 550 gallons of gasoline annually used by most motorists is practically thrown away.

WOULDN'T you like to increase your mileage 23 per cent? That is what these government engineers did in the case of one popular-priced car, by simply adjusting the carburetor scientifically. And they have had similar success with many other makes.

You can do likewise. Harold F. Blanchard, POPULAR SCIENCE MONTHLY'S automobile expert, tells in the next issue how to make these simple attachments.

Your Radio Problems

DON'T miss Jack Binns' "Ten Commandments for the Users of Vacuum Tube Sets." It gives expert advice and information to every man interested in radio.

"Standard Radio Guide"

THIS is the ideal book for the radio amateur. It tells simply and clearly all you want to know. It was written by the Radio Editor of POPULAR SCIENCE MONTHLY and answers all the questions our readers have asked about radio.

Price 50 cents postpaid.

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Seventy New Ideas for Tool Users, pages 77-128

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POPULAR SCIENCE MONTHLY

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POPULAR SCIENCE MONTHLY,
225 W. 39th St.,
New York, N. Y.

Send me, postpaid, your handbook, "The Standard Radio Guide." I inclose Fifty Cents (cash, check, or money order).

NAME .....

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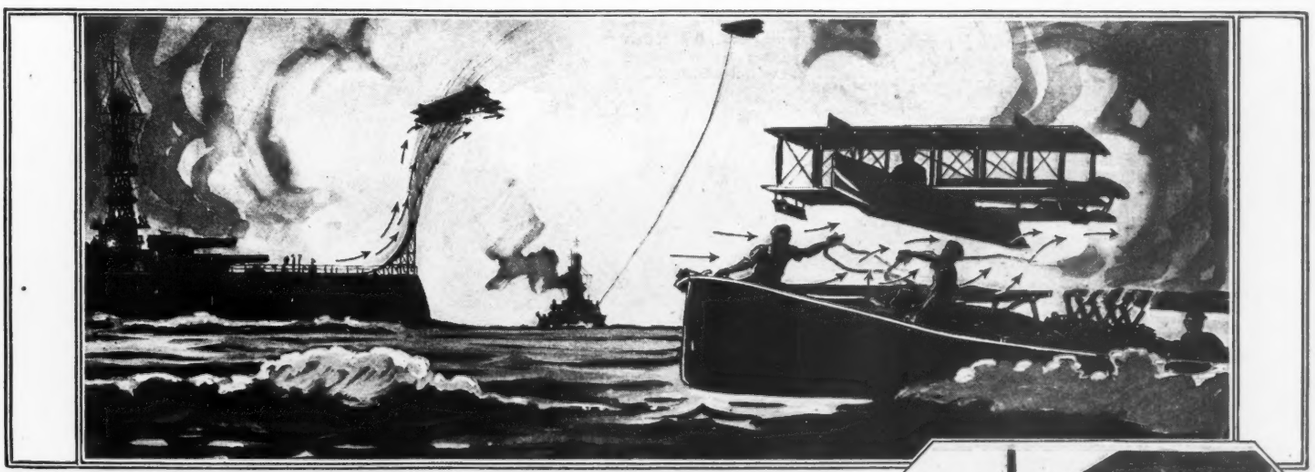
POPULAR SCIENCE MONTHLY
November 1922

How Thrilling New Sport of Aerial Yachting May Develop from Recent Sailplane Contests

Famous Airman Predicts Astounding New Era of Popular Flight



In the following article, Augustus Post, leading American aeronautic expert, discusses the amazing future of soaring flight, as revealed since the records made by German sailplane pilots in the Rhön valley, a few weeks ago.

Glenn Curtiss has been one of the first on this side of the Atlantic to follow up the German exploits, and Mr. Post's vision of the possibilities of the Curtiss sailplane is pictured above. He believes the Navy may make use, for training purposes, of sailplanes launched from battleships, and riding on air currents in their wake; that motorless planes may be towed by a warship, like kites, to serve as observation posts for the direction of gunfire; and that, finally, for sport, a sailplane may be carried or towed by a swift power boat until it gains speed enough to rise and soar

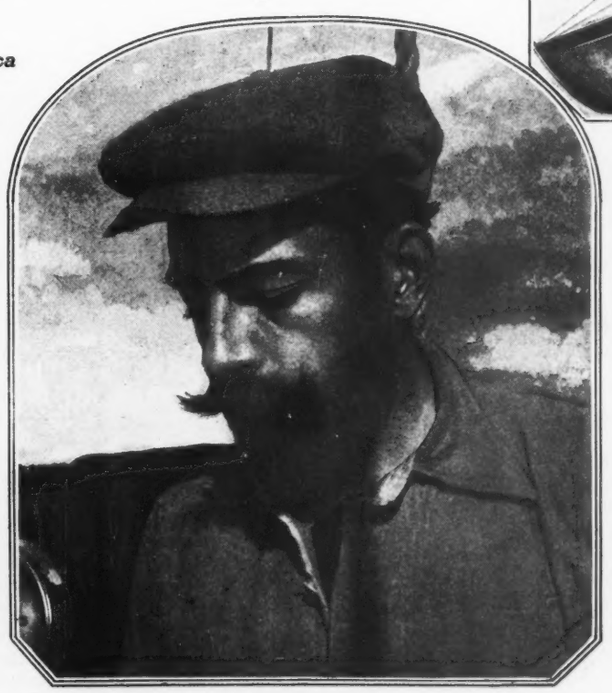
Glenn H. Curtiss, inventor of the flying boat and father of commercial aviation in America, with his revolutionary sailplane. In recent successful tests, this remarkable 150-pound craft, towed by a power boat, rose and soared above the water, as shown at the right of the upper picture. The hull is of duralumin, exceedingly light and strong, while the wings are silk covered

By Augustus Post
Secretary, Aero Club of America

MAN has never really flown; he has only made machines that fly. From the time when the Greek myths told how Icarus flew so near the sun that the wax holding his wings was melted, to the time that Leonardo da Vinci, the great Italian painter, drew plans for mechanical wings, even to the day of "Langley's Folly," men have *dreamed* of human flight. But all they have lately accomplished is to make high powered machines able to lift themselves into the air and carry men up with them.

But a new era has begun. Man has learned actually to fly without motor power. The vision of Otto Lilienthal, pioneer student of flying, the dream of the Wright brothers when they began their experiments at Kitty Hawk, have become a reality.

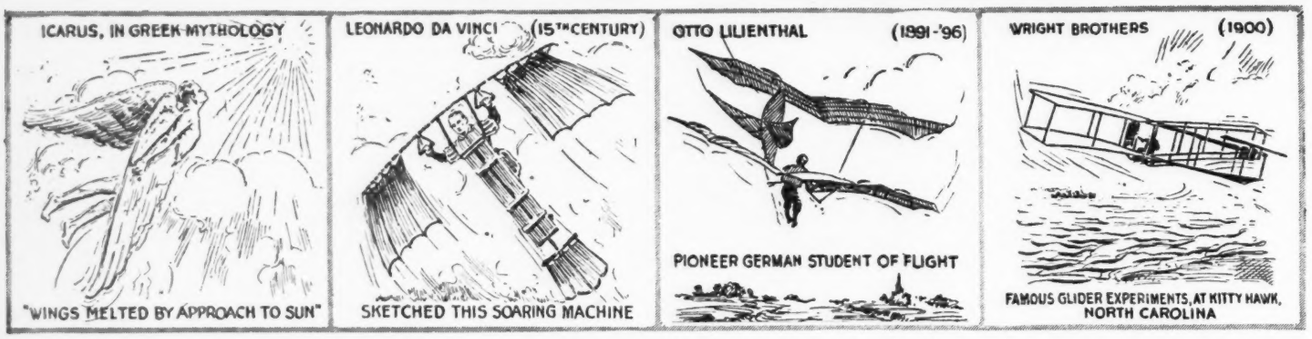
When, a few weeks ago, the young German sailplane pilot, H. P. Hentzen, soared in a motorless sailplane high over the German countryside at Gersfeld in the Rhön mountains, remaining aloft



Augustus Post in the car of the balloon, "New York," at 20,000 feet, during flight that established duration record of 48 hours, 26 minutes. (See note, page 27)

for more than three hours and descending only "on account of darkness," the astounded world realized that something brand new in aviation, practical and far-reaching in scope, had come to stay. Do you grasp the full significance of the exploit? Without an engine, with only piloting skill and knowledge of wind currents, this young bird-man—for the first time the name really fits—actually hovered and soared over the landscape for as long as it takes a

The Evolution of Flight—From Dreams of Birdlike Soaring,


ICARUS, IN GREEK MYTHOLOGY
"WINGS MELTED BY APPROACH TO SUN"
LEONARDO DA VINCI (15TH CENTURY)
SKETCHED THIS SOARING MACHINE
OTTO LILIENTHAL (1891-'96)
PIONEER GERMAN STUDENT OF FLIGHT
WRIGHT BROTHERS (1900)
FAMOUS GLIDER EXPERIMENTS, AT KITTY HAWK, NORTH CAROLINA

fast train to travel from Albany to New York City. And he landed more than 1100 feet above his starting point!

Only a few years ago the feat of remaining aloft for a few moments, after gliding downward from the top of a high hill, was considered remarkable. Soaring for a quarter of an hour, last year in Germany, was thought amazing; but this year the young technical students, Hentzen, Johann Martens, and others, climbing and hovering like birds for hours instead of minutes during the Rhön contests, have simply staggered us.

Air Yachting as Popular Sport

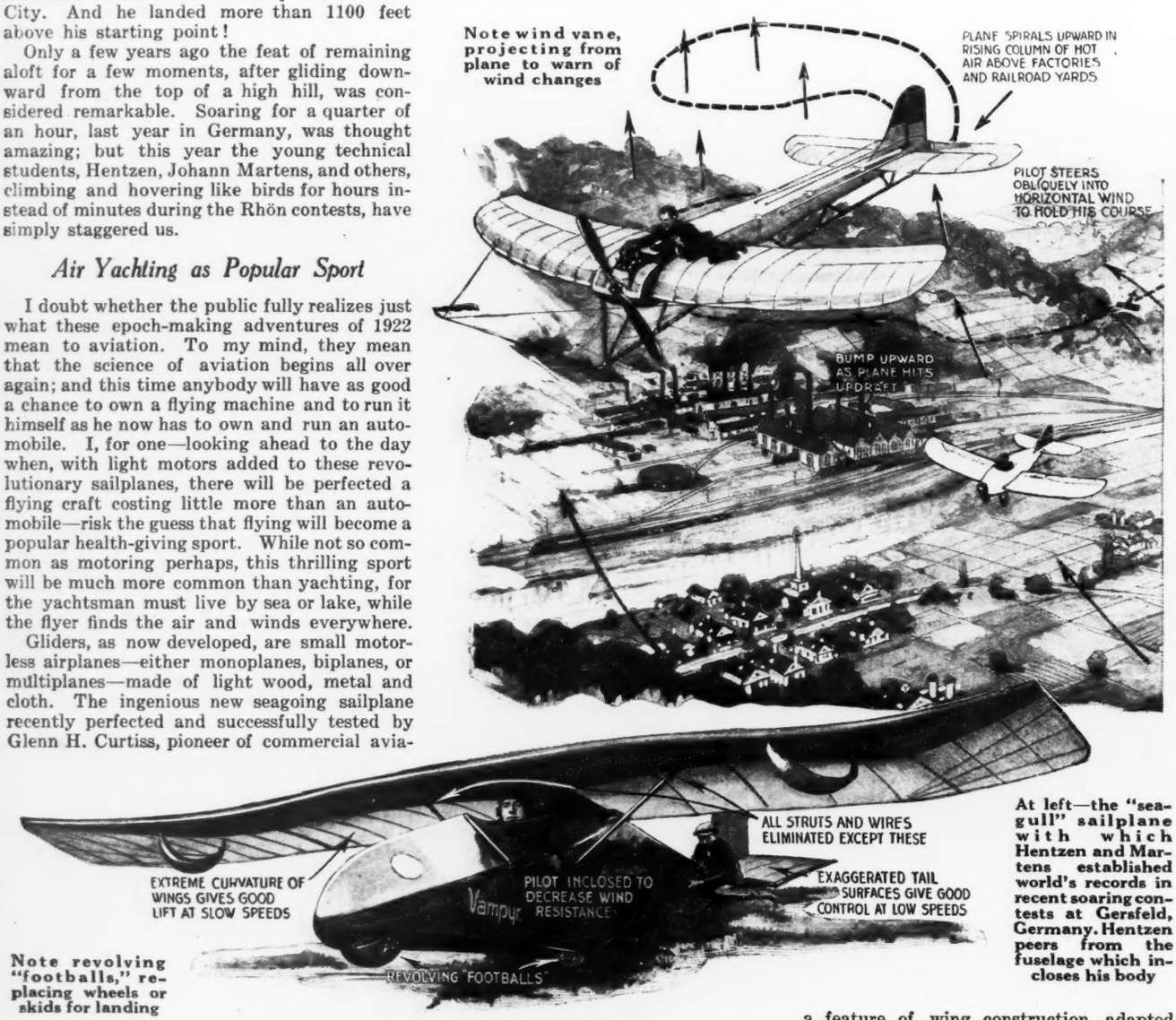
I doubt whether the public fully realizes just what these epoch-making adventures of 1922 mean to aviation. To my mind, they mean that the science of aviation begins all over again; and this time anybody will have as good a chance to own a flying machine and to run it himself as he now has to own and run an automobile. I, for one—looking ahead to the day when, with light motors added to these revolutionary sailplanes, there will be perfected a flying craft costing little more than an automobile—risk the guess that flying will become a popular health-giving sport. While not so common as motoring perhaps, this thrilling sport will be much more common than yachting, for the yachtsman must live by sea or lake, while the flyer finds the air and winds everywhere.

Gliders, as now developed, are small motorless airplanes—either monoplanes, biplanes, or multiplanes—made of light wood, metal and cloth. The ingenious new seagoing sailplane recently perfected and successfully tested by Glenn H. Curtiss, pioneer of commercial aviation in America, has a hull of duralumin, a metal more than twice as strong and as light as aluminum. In some types of sailplanes the pilot sits in the fuselage or body, as in the cockpit of an airplane; in others he sits in a seat beneath the wing. In each case he operates rudder, ailerons, and elevators as in an airplane, and in some machines even the wings may be adjusted by the pilot to gain a better balance for the machine.

The record breaking "air yacht" Vampyr, used by the students Hentzen and Martens at Gersfeld, resembles in the air a huge, ungainly, angular seagull. In structural detail the single deck plane is closely modeled after soaring and skimming birds. Extreme curvature of the wings gives remarkable lifting power at low speeds, while the ends of the wings consist of warpable surfaces, controlled from the pilot's seat, by means of which the tapering wings are instantly adjusted to varying air currents.

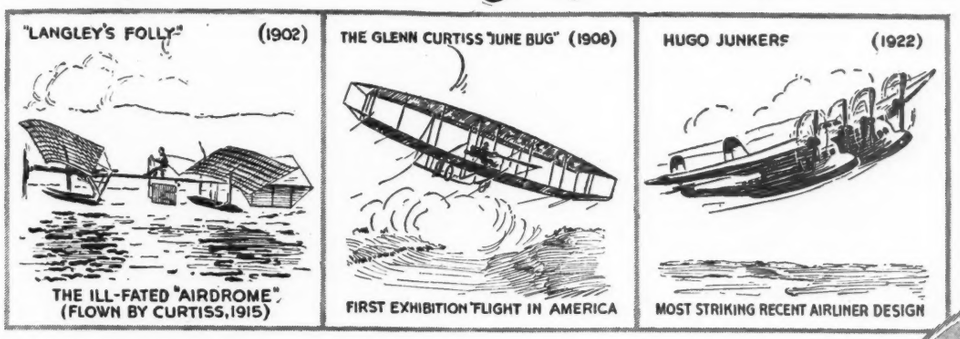
To decrease wind resistance, the pilot is inclosed in the streamlined fuselage, which terminates in a steering tail. Only his head is exposed. The center of the wings, just above the pilot, is often curved to an arch, a feature of wing construction adapted from nature's models.

The hop-off of the Vampyr for its record flight is typical of the manner in which a sailplane, as now constructed, takes the air. As the machine takes its place on the slope of the Wasserkuppe, highest hill in the Rhön range, each of three husky fellow students of the pilot holds the end of a rope that is thrown through a hook just beneath the machine's nose. After some jockeying with the wind, the pilot, picking a favorable moment, signals for the start, and the three students run down the hill, facing the wind, hauling the sailplane behind them. With a slight lurch, the wings catch the air;

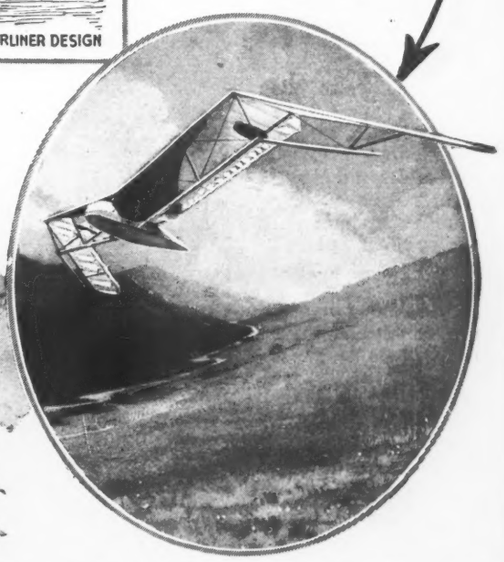

Note wind vane, projecting from plane to warn of wind changes
PLANE SPIRALS UPWARD IN RISING COLUMN OF HOT AIR ABOVE FACTORIES AND RAILROAD YARDS
PILOT STEERS OBLIQUELY INTO HORIZONTAL WIND TO HOLD HIS COURSE
BUMP UPWARD AS PLANE HITS UPDRAFT
ALL STRUTS AND WIRES ELIMINATED EXCEPT THESE
EXTREME CURVATURE OF WINGS GIVES GOOD LIFT AT SLOW SPEEDS
PILOT INCLOSED TO DECREASE WIND RESISTANCE
Vampyr
EXAGGERATED TAIL SURFACES GIVE GOOD CONTROL AT LOW SPEEDS
REVOLVING "FOOTBALLS"
Note revolving "footballs," replacing wheels or skids for landing

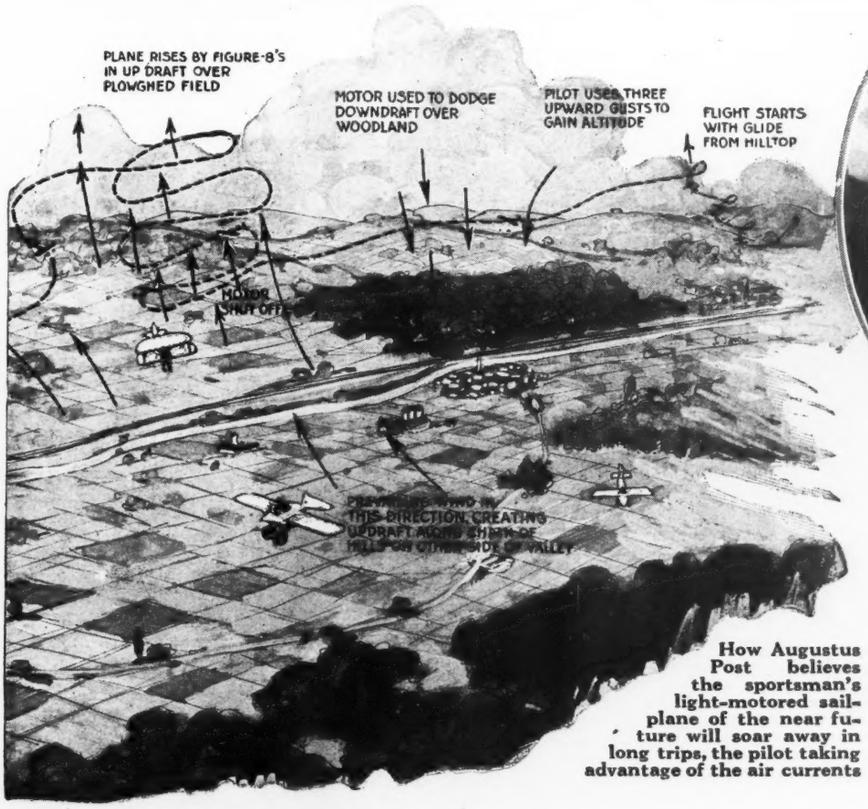
At left—the "seagull" sailplane with which Hentzen and Martens established world's records in recent soaring contests at Gersfeld, Germany. Hentzen peers from the fuselage which incloses his body

through Powered Flying, Back to Soaring Again


"LANGLEY'S FOLLY" (1902)
THE ILL-FATED "AIRDROME" (FLOWN BY CURTISS, 1915)
THE GLENN CURTISS "JUNE BUG" (1908)
FIRST EXHIBITION FLIGHT IN AMERICA
HUGO JUNKERS (1922)
MOST STRIKING RECENT AIRLINER DESIGN

AS THE culmination of a quarter of a century of soaring experiments and powered flight, comes the popular priced air yacht (below), now manufactured in Germany. This sailplane is being marketed, with or without nine horsepower motor, at prices ranging from $100 to $650




PLANE RISES BY FIGURE-8'S IN UP DRAFT OVER PLOWGHED FIELD
MOTOR USED TO DODGE DOWNDRAFT OVER WOODLAND
PILOT USES THREE UPWARD GUSTS TO GAIN ALTITODE
FLIGHT STARTS WITH GLIDE FROM HILLTOP
MOTOR SHUT OFF

How Augustus Post believes the sportsman's light-motored sailplane of the near future will soar away in long trips, the pilot taking advantage of the air currents

the ropes are jerked clear of their hook, and the plane soars away, on a level course, to the crest of the next hill where, catching a new current, it rises higher, then descends slightly until another current is encountered.

Assuming that some day—and that day may be soon—you will pilot your own sailplane, how will you guide it? How will you travel and climb in such a craft? What will make it go?

The motor power you will use in "soaring" or "sailing" flight will be derived from using the force of air gusts within the wind and the energy of rising air currents to offset the action of gravity. You will find two kinds of wind suitable for soaring. First, winds that blow upward, due to the slope of the ground—such as the slope of a hill, mountain, ridge, or range of mountains—also rising columns of air over heated areas on the ground—such as plowed fields, deserts and extensive manufacturing districts. Second, horizontal winds with strong gusts.

Rising in a vertical wind is not, properly speaking, "soaring"; it is really the same as ordinary gliding flight, except that the wind is blowing upward. True soaring flight—the aim of all the present experiments—uses the energy of a gusty wind, generally horizontal, to soar over practically level ground. The long flights by Martens and Hentzen were combined soaring and gliding flights, thrilling accomplishments of skill that lend the most intense interest to the new sport of "air yachting." All the nautical terms such as "tacking," "running free," "before the wind," may be applied, with modern improvements, to this new three-dimension sport. Herr Klemperer, whose duration records of 1921 were described in a recent issue of POPULAR SCIENCE MONTHLY, says that piloting a soaring machine is quite different from flying an airplane with a motor, but that a good airplane pilot might have the advantage of air experience over the novice.

Certain it is that success in "air yachting" requires complete mastery of the knowledge of air currents and meteorological conditions in order to make instant decisions in difficult situations and to take advantage of the variations of wind speed in the form of gusts representing energy available for soaring. The pilot must so maneuver that there will be a constant wind speed behind his machine, thereby using the energy liberated from the gusts to perform the work necessary for flight. Because we cannot "see" air, such maneuvers are difficult, for we do not know the exact form, periodicity, duration, or relative strength of the gusts.

The best gusts for soaring are those with a long period of increasing speed, followed by one of constant maximum, then gradual decrease and finally a period of minimum strength.

(*Continued on page 94*)

Augustus Post Knows the Secrets of the Air

THIS article represents the first really authoritative magazine contribution in this country in reference to the amazing record of the German sailplane fliers, to come from an expert who, both as writer and aeronaut, stands among the nation's leaders. Augustus Post can explain and predict the astonishing possibilities of soaring motorless through the air because he *knows* the air, "inside and out."

Mr. Post, one of the founders of the Aero Club of America, has himself built and operated gliders; he was associated with the Wright brothers in their early experiments; he organized the first international balloon race in St. Louis, in 1907; and he holds America's record for distance of balloon travel in a single flight.

As lecturer, writer and organizer, he has been a leader preëminent in the development of all forms of aeronautical activity in this country, and his extensive ballooning experience—in the course of which he was compelled to study air currents as few pilots of airplanes have to—has put him in position to explain, as he vividly does in this article, the secrets of the astonishing soaring experiments in Germany.

How Plant Hunters Risk Lives to Find New Foods for Your Table

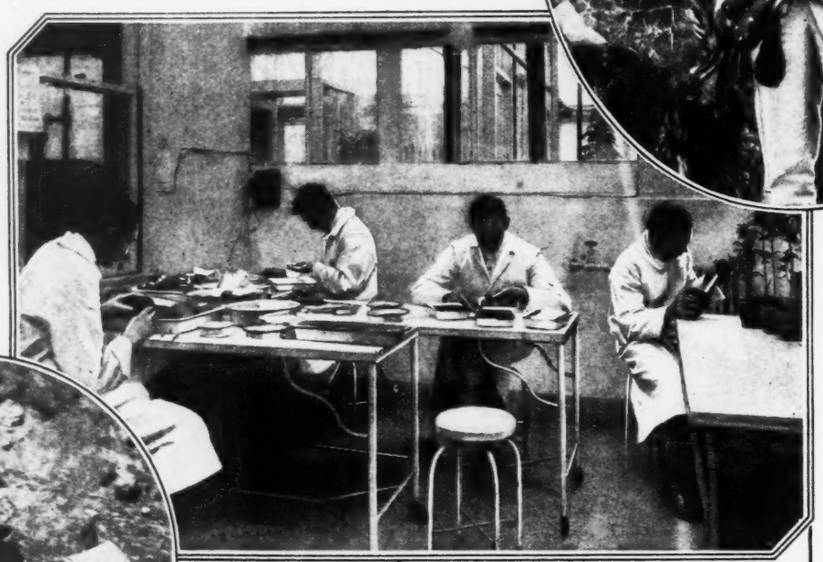
By E. L. Jones, from an exclusive interview for POPULAR SCIENCE MONTHLY *with* **Henry C. Wallace,** *Secretary of Agriculture*

THEIR achievements almost unnoticed by the very public that has gained wealth and a wider choice of wholesome food through their efforts, a little band of globe-trotting plant hunters from the United States Department of Agriculture, has succeeded in the past 25 years in locating in foreign countries, and introducing into this country, more than 51,000 lots of grains, fruits, forage crops, vegetables and plants regarded as worthy the attention of American plant breeders and experimenters.

Almost every year, one or more of these new crops appears for the first time in the list of America's valuable farm products. In December, 1921, the grain known as durum wheat, first brought to this country from Russia, had a value of about $30,000,000 on the farm. Egyptian cotton, to name a second discovery of the plant hunters, yearly enriches Southwestern planters by more than $6,000,000. Still other products, such as Japanese rice and Sudan grass, add annually another $25,000,000 to the producing value of the soil.

These Columbuses of the plant world know the remote places of the sphere as few real explorers can. They travel through tropical jungles where boa constrictors, tigers, lions and leopards lie in wait for human prey. They travel on foot

Above: Dr. David Fairchild, father of Uncle Sam's Service of Foreign Seed and Plant Introduction, of which he is now director. Giant bamboo forests in California, for which Doctor Fairchild sent from China the first cuttings 25 years ago, are living monuments to his work, while the mango, India's "sacred fruit," now being grown in our own South, is gradually winning popular favor as a result of Doctor Fairchild's efforts



© Harris & Ewing

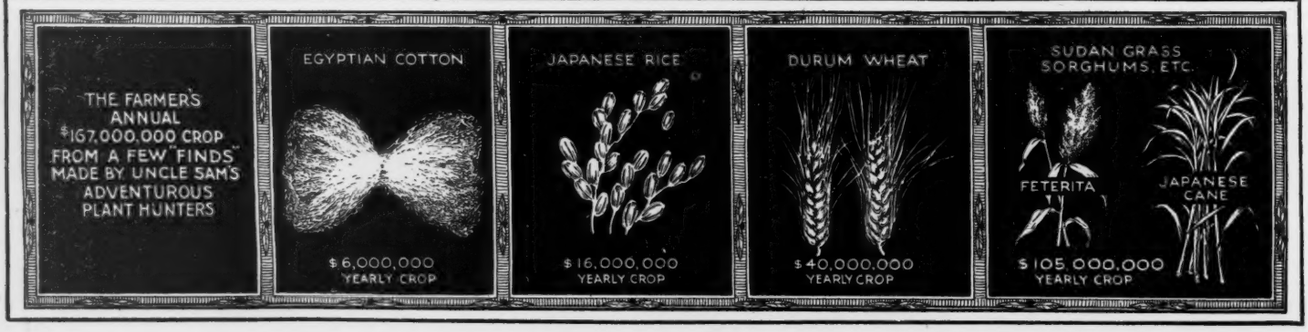
An "Ellis Island" for Immigrant Plants

HUNDREDS of food delicacies have passed through this fumigated laboratory in the Department of Agriculture, Washington, and become citizens of American soil. It is here that seeds and roots, sent from all over the world by our plant hunters, are examined for insects or diseases that might prove dangerous if admitted.

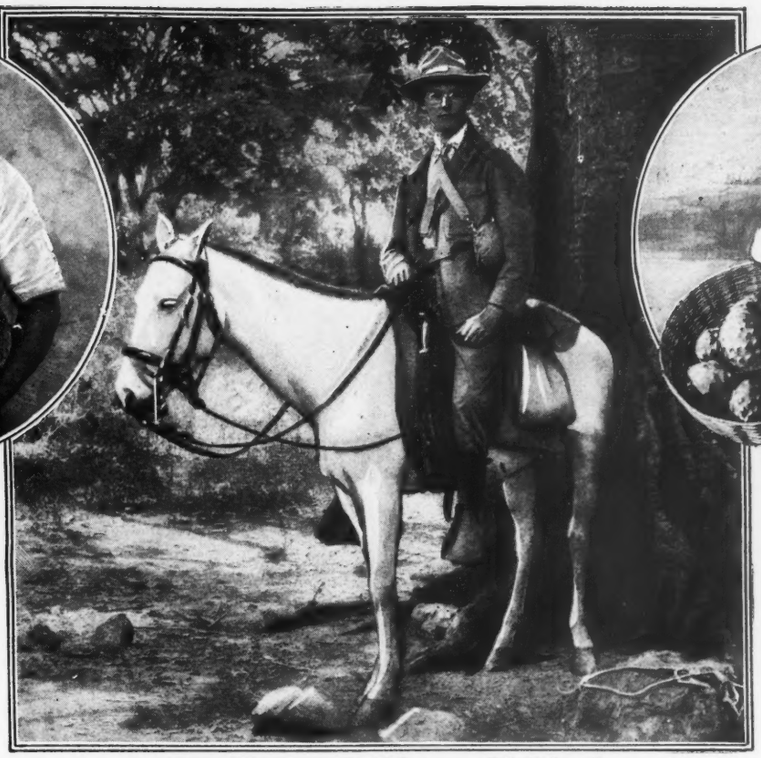
According to Doctor Fairchild, Uncle Sam's pioneer plant explorer, if one per cent of the money spent in advertising chewing gums or breakfast cereals could be applied to advertising the varied vegetable immigrants thus introduced, the American dinner table would boast scores of new, cheaper, and more wholesome foods. Among the new crops that are still neglected by the general public simply from habit or lack of knowledge of their advantages, are the following:

Guatemalan avocado, a fruit more nourishing than bread or rice; Guatemalan chayote, a vegetable resembling our squash; dasheen from the West Indies, a potato-like root crop that grows in sections of the South where potatoes will not thrive; Colombian giant blackberry, the world's largest edible berry, growing to a length of 2½ inches; Andes berry, like the raspberry in growth, with fruit resembling our blackberry; Andean cherry, large and sweet; pejibaye, a Costa Rican plum, the size of an apricot and resembling the chestnut in character and flavor; telfaeria, a gourd seed from German East Africa, about one inch in diameter and tasting like our butternut; soy bean from China and Japan, nutritious, rich in oil, with nutty flavor; Indian mango, a fruit with combination apricot and pineapple flavor

Dr. Frank N. Meyer, a pioneer plant hunter, who for nine adventurous years enriched American gardens with innumerable choice plants and flowers, and finally perished while seeking new foods for us in a remote corner of Asia



Vegetable Ice Cream
From the South American Andes, the cherimoya, or "vegetable ice cream," was introduced into this country by Wilson Popenoe (center) and now flourishes in California. The inner part of the vegetable, a creamy white substance, blends pineapple and banana flavors



Five Thousand Miles on Muleback
Wilson Popenoe, one of the most persistent of Uncle Sam's plant hunters, who for the past 10 years has been traveling through tropical America in search of new fruit varieties. In his quest he has ridden at least 5000 miles on muleback, as shown above, usually with only an Indian companion

Fruit from Guatemala
Introduced by Wilson Popenoe, the Guatemalan avocado, or alligator pear, of which fine specimens now being grown in California and Florida are declared to be remarkable delicacies and far superior to the alligator pears that prematurely reached the market a few years ago

through swampy terrain, where the chances of escaping the jungle fevers are 99 to one against the white man. Their only goal, through all the suffering and privation, is a mere plant which, if introduced into the agricultural life of America, may add, it is hoped, to the farm wealth and food resources of the country.

Despite myriad dangers, the intrepid plant hunters of the United States Department of Agriculture are constantly penetrating the wildernesses of Africa, China, Manchuria, the Philippines, South America, Egypt, and elsewhere, veritably combing these distant regions for samples of native plant treasures that may be introduced to America and tested out on our soil. If the new products are found satisfactory, they are added as permanent assets to our crop schedules in those sections of the country where they prosper. *The range of climatic, soil, and topographical conditions in the United States is so wide and varied that practically every crop or plant that can be grown anywhere else in the world can be raised successfully in some part of the United States.* Some of our agricultural lands that previously were relatively cheap and unimportant, have been made valuable as a consequence of the introduction of certain foreign crops that were found to be ideally adapted to the particular soil and climate of the region.

Farmers in the north plains states (North and South Dakota, western Minnesota and Montana) depend largely on the high-yielding durum wheat that was first introduced from Russia (it constitutes 15 per cent of the spring wheat crop). The area devoted to this crop averages 3½ million acres. In 1921 it was almost five million. In the past five years, the quantity raised annually has ranged from 26,000,000 to 50,000,000 bushels. The average annual production, at one dollar a bushel, would amount to $40,000,000.

California is now able to market in excess of 13,000,000 boxes of navel oranges annually, as a result of the introduction of this fruit from Brazil. Our average Japanese rice crop of over 47,000,000 bushels, in the past three years, is valued at an average of $16,000,000 a year. The comparatively small sum that the government spent in studying, introducing and establishing this industry was well invested.

Corn would never grow satisfactorily in the southwestern and plains states. The importation of Sudan grass, and of grain sorghums, including kafir, milo and feterita —drought resisting grain crops—found and introduced by Uncle Sam's plant hunters—now enables farmers in these semi-arid regions to grow about $105,000,000 worth of these crops annually. Egyptian cotton, introduced by the same agencies, yields annually approximately 17,500,000 pounds of

(*Continued on page 98*)

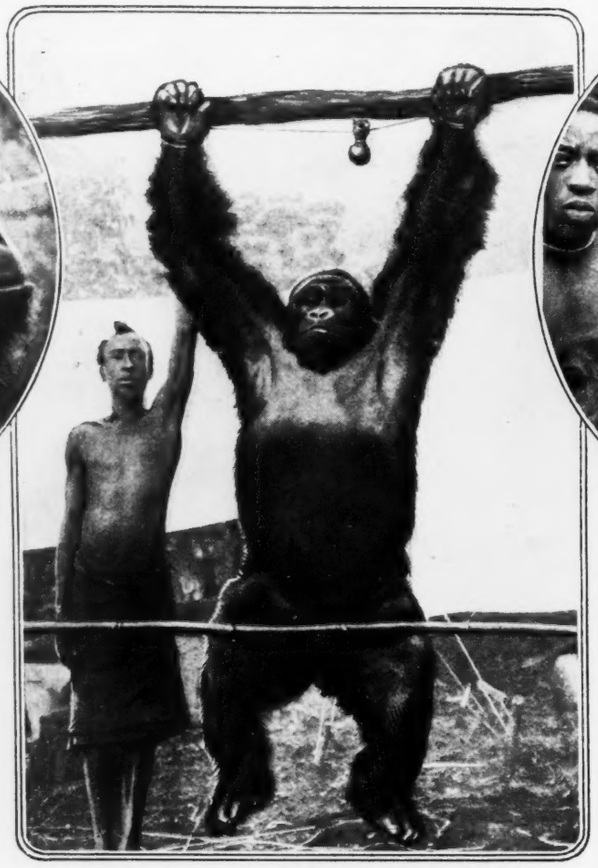
This baby elephant was captured by Plant Hunter H. L. Shantz, during his 9000-mile expedition into Africa

The upper picture shows Dr. H. L. Shantz examining a wild cotton plant in Anglo-Egyptian Sudan, Africa

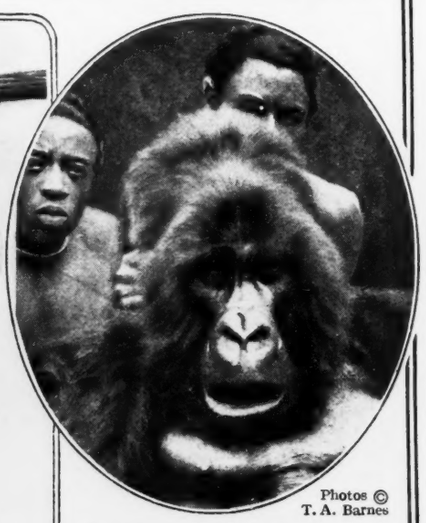
How Doctor Shantz and his expedition traveled through Central Congo. Note the dugout canoes carried by rail

Here Are the Most Wonderful Gorilla "Portraits" Ever Taken!

Profile of an old male gorilla, showing the distinguishing high crest at back of head, the heavy, bulging brow, ridiculously small ears and the tremendously powerful jaw



Compared with this giant gorilla from Lake Kivu, Belgian Congo, the African native, standing five feet ten inches tall, looks puny. Note the animal's long, powerful arms, short legs and bare breast. He weighs more than 450 pounds



Photos © T. A. Barnes

Ferocious? Yes — but this shaggy head, twice the size of a man's, incloses a brain that for intellectual capacity is nearest approach to human

THE amazing gorilla photographs reproduced here are not only the most remarkable pictures of their kind ever published, but are a valuable addition to scientific knowledge of the fierce "manlike" ape—the rarest and largest of all the ape tribe. They were obtained by T. W. Barnes, Fellow of the British Royal Geographic Society, during a recent expedition into the wild gorilla country west of Lake Kivu in the Belgian Congo, Central Africa.

Because little has been known of the actual life and habits of the gorilla, although of all anthropoid apes he and the chimpanzee represent the nearest approach to man in bodily form and intelligence, these photographs are of exceptional interest.

The center picture, showing an African native, five feet 10 inches tall, standing beside one of the manlike monsters of the Lake Kivu country, gives an idea of the gorilla's enormous bulk and power. Standing nearly seven feet high, and with a chest girth of 61 inches, he weighs more than 450 pounds.

The photograph at the left—a profile of an old male gorilla—reveals a strange distinguishing mark of the species—the high crest at the back of the head, forming a great plate of bone for the attachment of muscles of the jaws, which are so powerful, it is said, that they can flatten a gun barrel.

In the photograph at the right, note the wide, wrinkled nostrils, and especially the heavy bulging brow ridges that also are marked characteristics of the so-called prehistoric "ape man" skull recently unearthed in Rhodesia, South Africa, and believed by some scientists to be that of the long sought "missing link." The Rhodesian skull was fully described in the March issue of POPULAR SCIENCE MONTHLY The gorilla's mental capacity has only recently been revealed. Dr. William T. Hornaday, director of the New York Zoological Park and an authority on wild animal life, in a report of recent observations on a captive young male gorilla when subjected to human environment, points out that these huge, savage-looking, manlike creatures may be capable not only of learning and adopting some of the civilized habits of human beings, but also of meeting puzzling situations with evidence of original thought.

Tunneled Stern Gives Super Speed to Twin Screw Racing Boat

BY AN ingenious arrangement of surface propellers inclosed within an air tunnel, George F. Couch, of New York City, has perfected what experts say is the first successful twin-screw racing boat in history—the Rainbow II, a marvel of speed that marks a valuable contribution to the science of speed boat design.

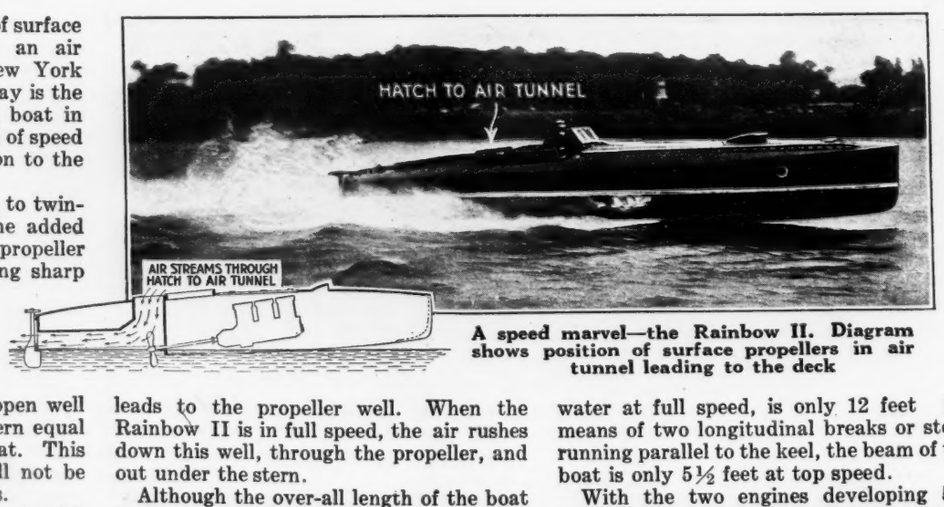
Heretofore the chief drawbacks to twin-screw displacement have been the added resistance of an extra submerged propeller shaft, and the difficulty of making sharp turns.

These difficulties Mr. Crouch has overcome by the use of surface propellers—only the lower parts of which are immersed. The propellers are placed in an open well located at a distance from the stern equal to one third the length of the boat. This position insures that steering will not be hampered in turning sharp corners.

To supply the propeller tunnel with circulation of air, an opening in the deck leads to the propeller well. When the Rainbow II is in full speed, the air rushes down this well, through the propeller, and out under the stern.

Although the over-all length of the boat is 32½ feet, the "wetted surface," which is that part of the hull in contact with the water at full speed, is only 12 feet By means of two longitudinal breaks or stops running parallel to the keel, the beam of the boat is only 5½ feet at top speed.

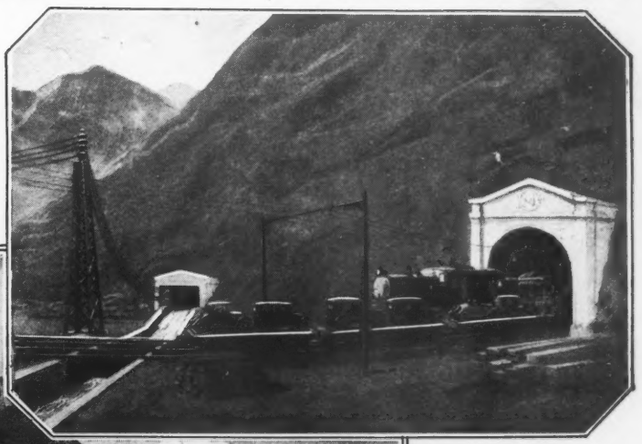
With the two engines developing 550 horsepower, the Rainbow II has attained a speed of 54 miles an hour in practice runs.

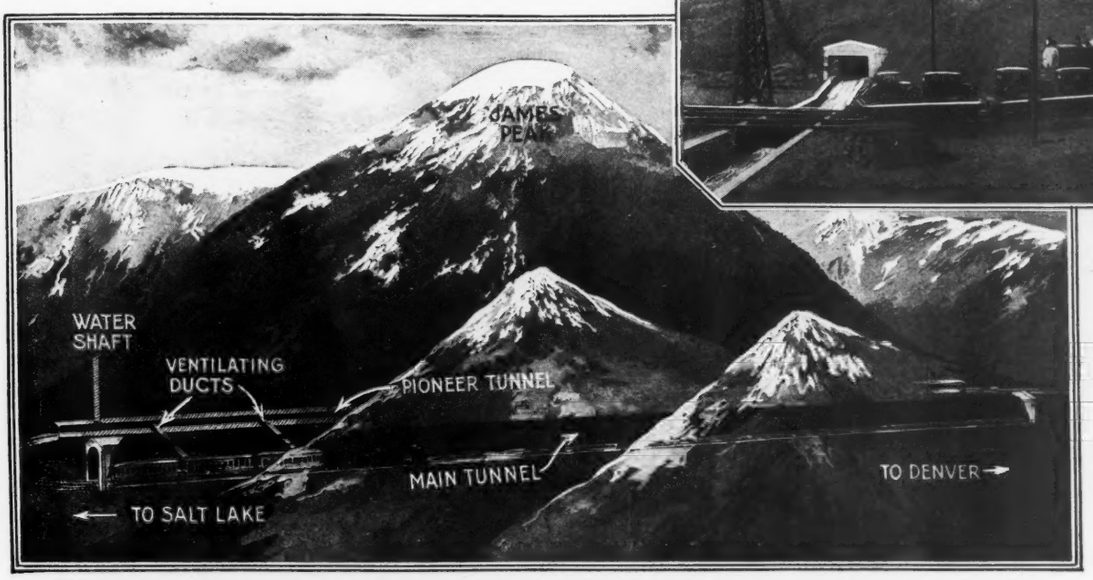


A speed marvel—the Rainbow II. Diagram shows position of surface propellers in air tunnel leading to the deck

How America's Longest Tunnel Will Pierce Rockies

Colorado's Six-Mile Bore through Continental Divide to Throw Vast Wealth Open to Nation





Transcontinental tourists in automobiles and motor trucks will be hauled through the tunnel on flat cars attached to the regular trains. The picture above shows the portals of the main, or traffic, tunnel and the secondary water tunnel, approximately as they will appear when completed

HOW America's longest tunnel—the proposed six-mile bore through James Peak, Colo.—will pierce the Continental Divide. This diagram shows the main tunnel and one end of the small "pioneer" tunnel, to be used first in construction of the main bore, and then to carry to Denver a fresh water supply from the western slopes of the Divide. Since the eastern or Denver end of the tunnel is 90 feet higher than the western, gravity pressure for this water must be obtained by means of an intake shaft on the western slope, with the intake at a point higher than the peak of the tunnel. Compressed air lines will also be carried through the pioneer tunnel, to ventilate the main tunnel through ducts connecting both bores at intervals. Electric service lines will pass through the same tunnel

HALF a mile below the snowy summit of James Peak—a 13,283-foot Rocky Mountain barrier in northern Colorado—work will soon start on the longest and, from an engineering standpoint, the most remarkable tunnel in the Western Hemisphere—a six-mile bore through the granite backbone of the Continental Divide, at a point 50 miles west of Denver, Colo., on the line of the Denver & Salt Lake Railroad.

Comparable in magnitude only with the famous 12-mile Simplon tunnel through the Alps, the great mountain-piercing tube, when completed, promises not only an important time-saving advance in transcontinental transportation, but the opening to the world of vast treasures of ore, coal, and timber.

Denver's "Place in the Sun"

Considered merely as a local enterprise, the James Peak tunnel will mark the final chapter in Denver's 60-year struggle for recognition as a transcontinental railroad center. It is expected to result quickly in a 30 per cent increase in the city's population as well as an enormous increase in its prosperity. But from a national standpoint completion of the tunnel—probably within the next 3½ years—will bring tremendous public advantages, of which the following, from the estimates of engineers and geologists, are the most outstanding:

Eight hours of railroad running time, represented in a distance of 154 miles, between Denver and the Pacific coast, will be saved.

The present shortest traveling distance across the continent will be shortened 73 miles, and four hours will be saved in transcontinental trips.

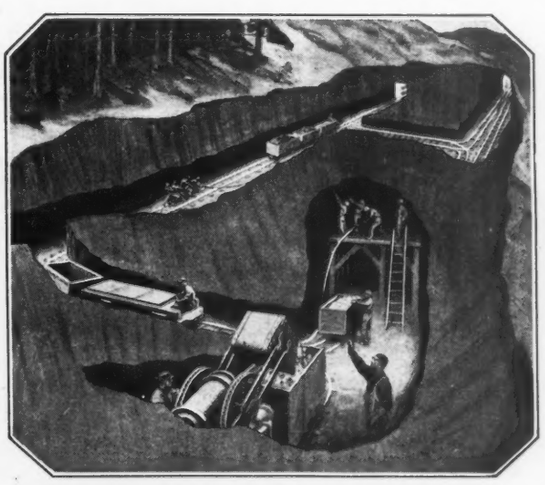
Maximum grades will be reduced from eight to two per cent.

Rich coalfields, estimated to contain more than 65,000,000,000 tons—enough to keep the whole United States supplied for 100 years—will be made available to world markets.

There will also be opened more than 2500 square miles of oil shale with an oil producing capacity of 50,000,000,000 barrels, and, as a by-product, 300,000,000 tons of sulphate of ammonia—enough to fertilize every farm in the Mississippi Valley.

More than 10,000,000,000 feet of timber will be made available for use.

Other natural resources that, according to these estimates, will become available, include copper ores, gold, radium ore, gypsum, graphite, lead, manganese, mercury, marble, salt, silver, slate, sulphur, tungsten and zinc.



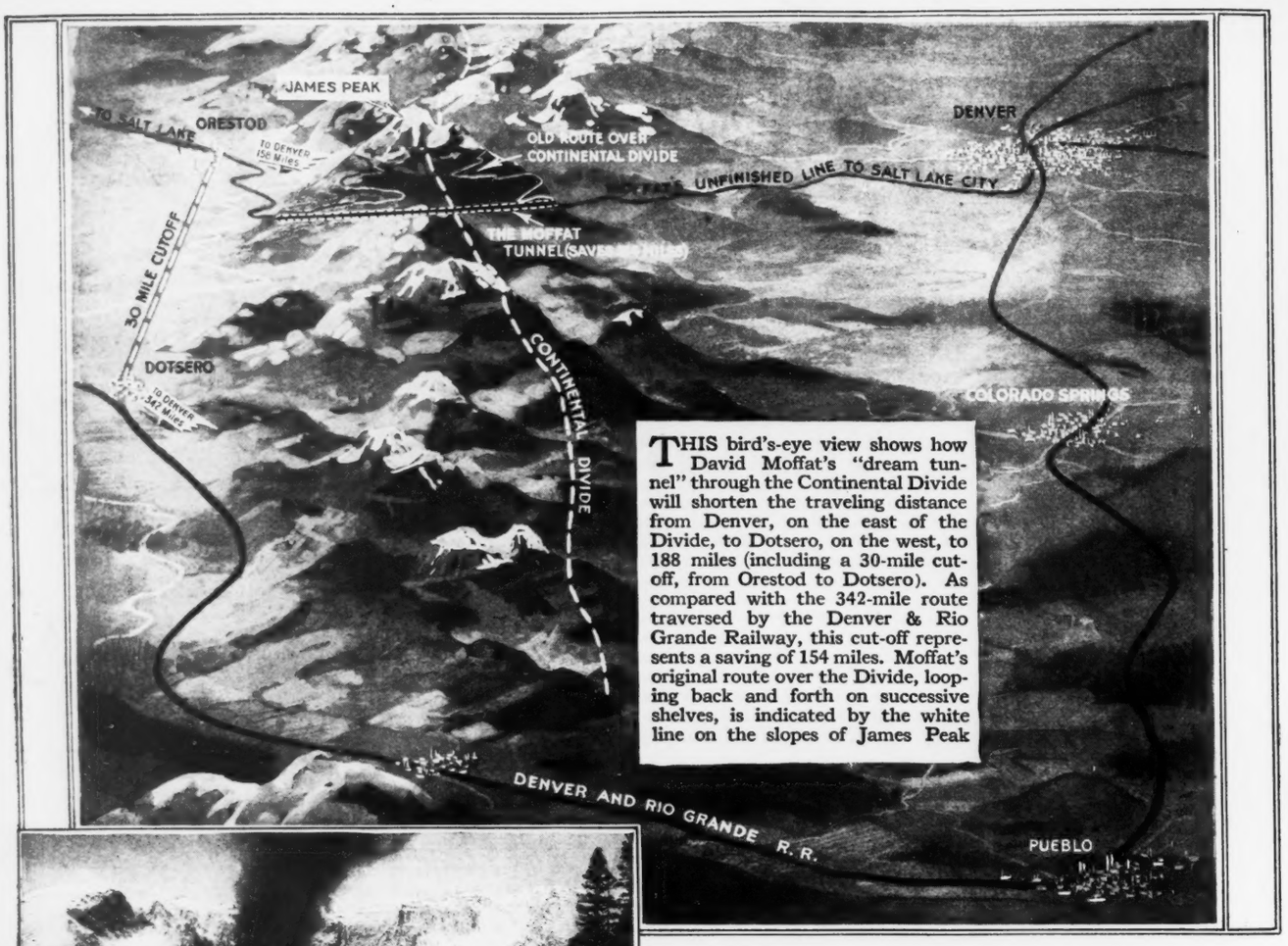
Instead of boring the Moffat tunnel only from each end, as is usually done, the engineers plan to construct first a small parallel "pioneer" tunnel, and, cutting through at various points from this to the line of the main tunnel, to dig the latter in both directions from these points, so that perhaps half a dozen sections of the six-mile underground tube may be under construction at once

Tunnel May Pay for Itself

Indeed, the cost of boring may have been met by unearthed treasures long before the first train passes the tunnel's portal.

The passage of that first train will be the climax of a dramatic battle to conquer a grim continental barrier, begun 54 years ago when David H. Moffat, "the grand old man of Denver," then 60 years old, threw his entire fortune and ability into the construction of the Denver & Rio Grande Railroad.

Faced by the unconquerable barrier of the Rockies, which are at their highest opposite Denver—the foothills being only 14 miles away—the city had seemed for many years to be hopelessly cut off from any direct route farther west, and was shunned by transcontinental railroads that selected other routes over the Rocky Moun-



THIS bird's-eye view shows how David Moffat's "dream tunnel" through the Continental Divide will shorten the traveling distance from Denver, on the east of the Divide, to Dotsero, on the west, to 188 miles (including a 30-mile cut-off, from Orestod to Dotsero). As compared with the 342-mile route traversed by the Denver & Rio Grande Railway, this cut-off represents a saving of 154 miles. Moffat's original route over the Divide, looping back and forth on successive shelves, is indicated by the white line on the slopes of James Peak

David H. Moffat (at right), who gave his fortune and life to building the railroad which, for lack of the tunnel he dreamed of but could not finance, had to climb, as shown above, almost impossible grades over snow-choked passes

tains. It was in 1868, that energetic citizens pledged their money to build the Denver & Rio Grande. This railroad gave Denver its first transcontinental connection, but the circuitous route which it followed proved to be a serious drawback. Dipping southward from Denver, the railroad that was supposed to connect the Colorado capital with the Pacific Coast meandered 160 miles without advancing an inch toward its ocean terminus, while it sought an opening in the Rockies through the Grand Canyon of the Arkansas and the Royal Gorge. The Santa Fé road also had its eyes on this route and the race to the gorge became a stirring contest of engineering skill. The Rio Grande won, and for years was the only railway line to the West from Denver.

The above bird's-eye view of the Continental Divide country in Colorado reveals how roundabout was the route.

Irritated by this waste in time and trackage, Moffat seized a ruler, one day in 1903, and placing it across a map of Colorado, east and west, exclaimed:

"I am going to build a railroad along the line of that ruler, west from Denver to Salt Lake!"

Work started immediately on the "Moffat Line" out of Denver to Salt Lake City, straight as the crow flies, over the Great Divide. Obstacles were met and conquered, but Moffat's millions dwindled. Determined to raise the money for the completion of his railroad, Moffat went to New York where, burdened with financial worries, he died in 1911.

He lived long enough to see the road completed as far as Steamboat Springs, about 100 miles northwest of Denver. Only one thing had made him deviate from his original straight line project. That one obstacle was James Peak.

The original Moffat road reached the slope of the peak at an elevation of 9190 feet. From there on, in a distance of 24 miles, the track rose to an elevation of 11,700 feet! Trains made their way slowly over this tremendous grade, and then only by looping back and forth on successive shelves. Twitted about this defect in the completion of his road, Moffat answered in his characteristic manner: "I intend to go through that mountain!"

After his death, work on the Moffat tunnel was considered frequently, but no real progress was made until early this year, when the Colorado legislature set aside $7,000,000 for completion of the project.

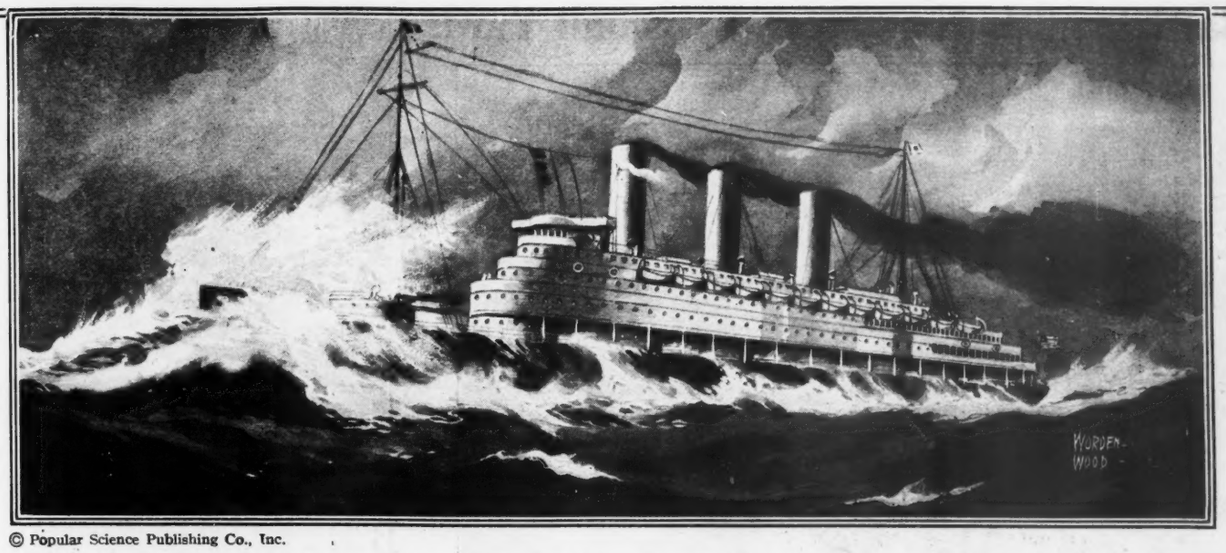
Route Shortened by 154 Miles

When the six-mile tunnel is completed, the line from Denver to Orestod, on the western slope of the Divide, will cover a distance of 158 miles. With a 30-mile cut-off from Orestod to Dotsero, the total distance by rail from Denver to Dotsero will be 188 miles, as compared with 342 miles over the circuitous Denver & Rio Grande.

The plan of construction calls for two bores—a small preliminary or "pioneer" bore, eight by 10 feet, to be driven first, and the main tunnel, to be 16 feet wide with a clearance of 24 feet. Rock from the main tunnel will be removed through galleys connecting with the pioneer bore.

Work will be started at both portals of each tunnel simultaneously. When the main tunnel is completed, electric locomotives, supplied with power from specially built generating stations, will haul not only trains, but motoring parties in their automobiles and motor trucks, on flat cars, through the great tube.

Eventually the small pioneer tunnel, designed primarily to aid in constructing the main tunnel, will be used for power transmission lines, telephone, telegraph, and light wires; while carrying also compressed air lines to ventilate the traffic tube through transverse ducts connecting the two tunnels.



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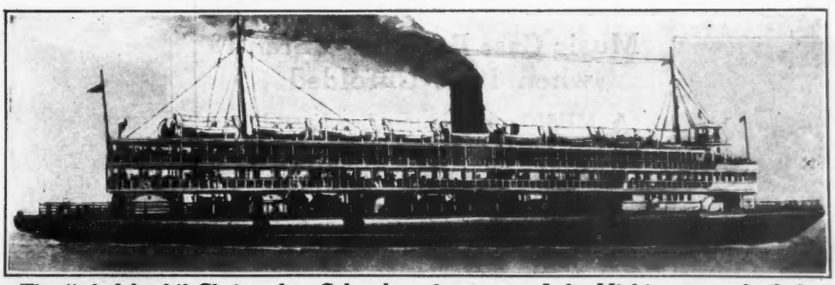
How the proposed McDougall rectangular ocean liner would plow through heavy seas. With passenger cabins supported on turrets high above the decks, the unusual vessel would be stabilized, the designer claims, by waves sweeping the deck

Sees Speed and Comfort in Flat Bottomed Liners

Veteran Designer of "Rectangular" Lake Freighters Predicts Economy for Similar Self-Stabilizing Ocean Vessels

THIRTY years of success in riding heavy seas on inland lakes and along coastwise cargo routes have so demonstrated the seaworthiness of the flat-bottomed, straight sided ships designed by Captain Alexander McDougall, of Duluth, Minn., that the veteran mariner now proposes the use of his long famous "rectangular" vessels in transoceanic service to replace the gracefully curved ocean liners with their higher construction cost and smaller cargo capacity.



The "whaleback" Christopher Columbus, famous on Lake Michigan, was built by Captain McDougall with the flat deck and turrets he now proposes for ocean liner

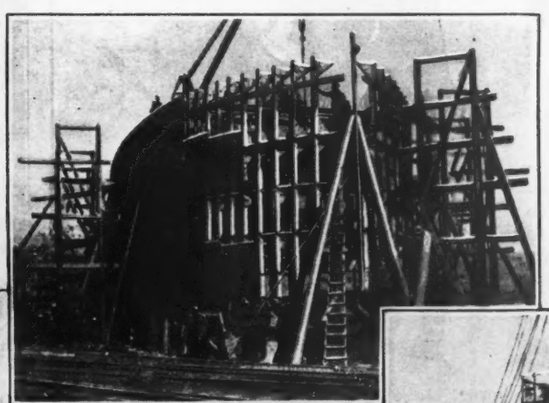
The feature that has spelled success for the McDougall rectangular ships in years of service is the flat deck placed low on the ship's frame with the deliberate purpose of permitting the crests of waves to wash aboard. When a McDougall ship noses into a comber, it picks up water and holds it for an appreciable time. This prevents the ship from rising at once and so reduces the pitching.

Because the outlines of the bottom and deck are practically identical in design, the construction of the ship is greatly simplified. After the shape has been marked out, the hull frames are laid in place from stem to stern and the upright frames riveted to them. Because of the flush deck, all side frames are of equal length. After they are riveted in place, deck frames corresponding exactly with the hull frames are attached to the uprights and the vessel is ready for the plates.

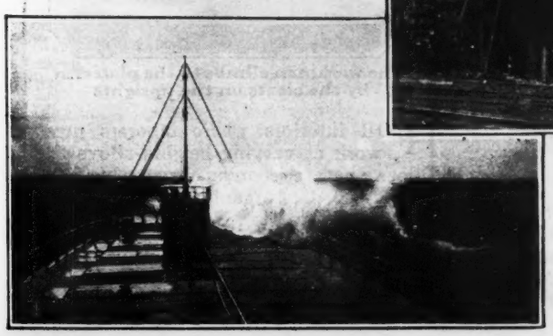
Rectangular ships cost less to build and to maintain because their straight sides allow the builder to use standard steel beams. The absence of curved bilges makes forming machinery unnecessary. Compared with an ordinary ship of equal size, the rectangular ship will have a greater cargo capacity, and will draw less water when fully loaded.

When the idea is applied to passenger ships, the same flat-decked hull is used. The cabins are supported on turrets resting on the flat deck. Waves taken aboard sweep along the flat deck and under the staterooms, but not over them.

Forty-five of the rectangular ships have already been built, most of them plying the Great Lakes.



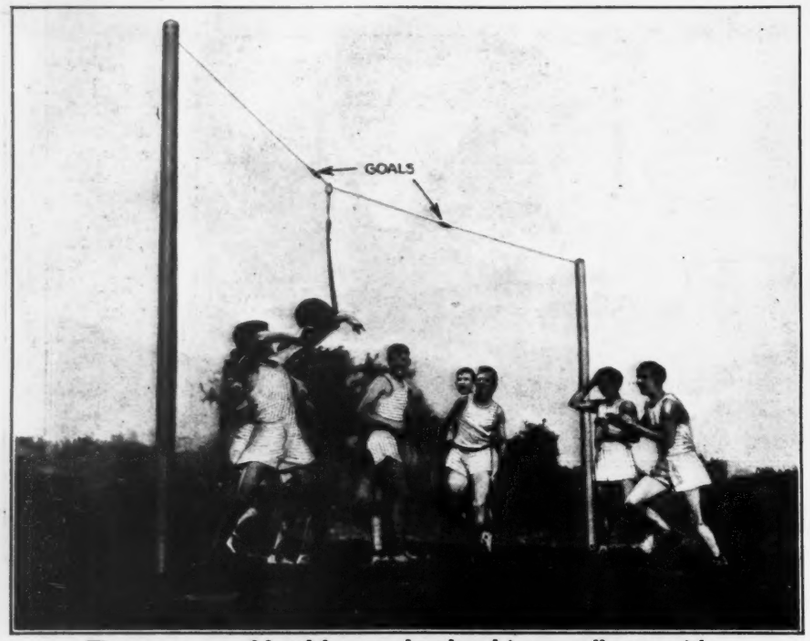
Below, photograph of one of McDougall's rectangular freighters, on the Great Lakes, shipping a sea. Note the flat deck



Simplicity of design is evident in the above photograph showing a McDougall flat bottomed ship under construction

A Great Lakes rectangular, flat-bottomed ship (below), adapted for use on canals, provides unusual deck cargo space

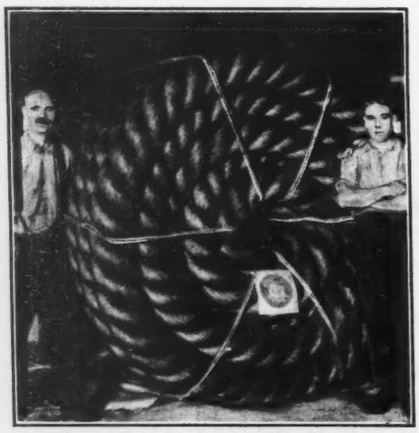
"Battlebag" Is New Sport for Small Yards



The new game of battlebag can be played in a small space either indoors or out by any number of players

"BATTLEBAG" is a new game devised for either indoor or outdoor sport. The apparatus consists of a horizontal wire stretched between posts, from which a punching bag is suspended by a loop. Knots are placed four feet away from each post to serve as goals.

In playing the game, the bag is suspended from the exact center of the wire with two players directly under it and the teams lined up at each end. At a given signal the two players strike it sharply and the other players advance to the scene. It is then a struggle to see which team first succeeds in sliding the ball by blows across the opposite knot.



This coir hawser is said to be the largest ever made

Largest Tow-Rope Is Spun from Cocoanut Fibers

A COIR hawser 24 inches in circumference, produced recently as a towline for a powerful seagoing tug, is believed to be the largest rope ever spun. It is by no means the strongest ever made, however, since coir—spun fibers of the cocoanut—is only about one quarter as strong, pound for pound, as rope of manila fibers, which are obtained from the leaves of the wild banana tree.

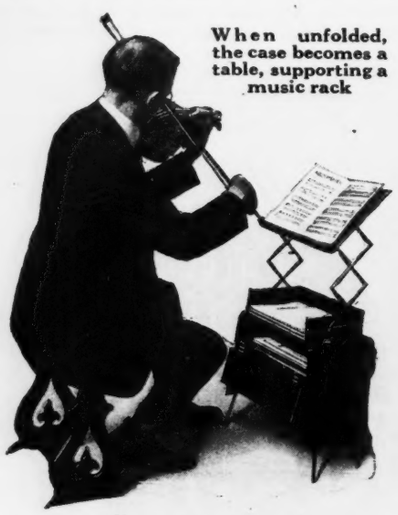
Coir is used to advantage because of its astonishingly light weight. It will float on the surface of the water, and therefore is much easier to handle in passing lines from one boat to another.

Many hawsers of this weight are needed to withstand the drag of even a medium size liner.

Music Case Becomes a Stand when It Is Unfolded

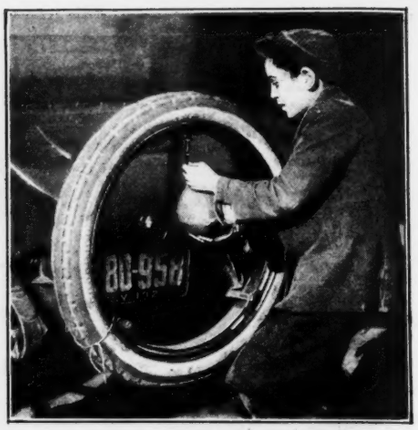
A MUSIC case that may be adjusted for use as a music stand has been invented by Edward L. O'Donnell, of St. Louis, Mo.

When closed, the device resembles a suitcase; but when opened for use, four metal legs drop down and support the case, one side of which, opening outward, reveals two compartments for the sheets of music.



When unfolded, the case becomes a table, supporting a music rack

Within the top compartment are lazy tongs that are extended to provide a support for the music rack. When the music support is depressed, it forms a side wall of the case, which, when folded, is neat enough to be carried anywhere.



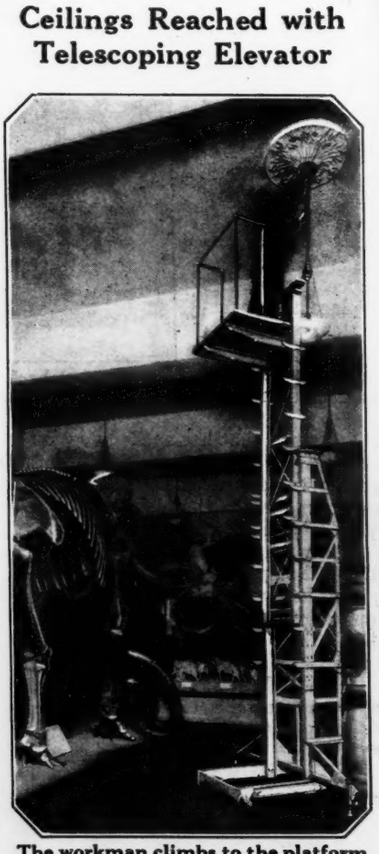
Boys Rob Tires of Air to Inflate Footballs

BOYS in New York have discovered that the easiest way to blow up a football is to "borrow" a little air from an auto tire—usually the spare at the rear of some unoccupied car.

By slipping the rubber tube of the bladder over the top of the valve, the football is inflated instantly, and without undue expenditure of effort.

However, the boys sometimes discover too late that the tire pressure is more than the ball can withstand and an explosion is the reward for their ingenuity.

Ceilings Reached with Telescoping Elevator



The workman climbs to the platform by the cleats on the uprights

FOR interiors where laborers must work at varying heights above the floor a new telescoping elevator has been perfected. It is manipulated by a hand crank at the base. The workman can also use the ladders at the side. For stability, two outriggers with friction cups are swung from the base.

New Detachable Reel Holds Hose without Kinking

ANY part of the hose or all of it may be unwound from a recently invented detachable hose-reel without becoming looped and kinked and again wound on the reel when no longer needed. The reel is attached to the faucet, around which it revolves freely.

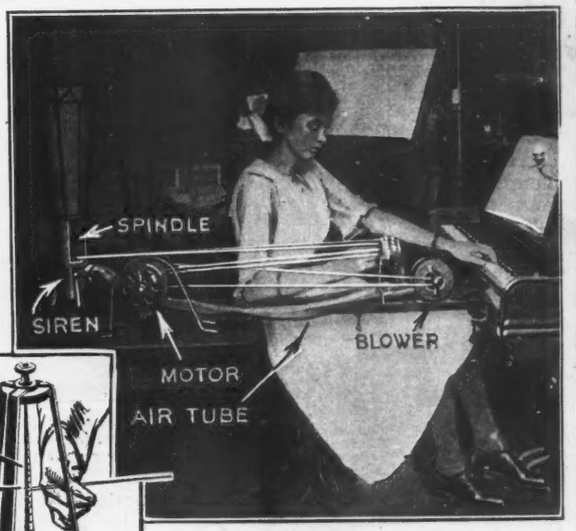
The hose is fitted by a screw joint into a hollow spoke of the reel. This spoke communicates with the axle, which is also hollow and fits into a special faucet that is permanently placed at the end of the service pipe.

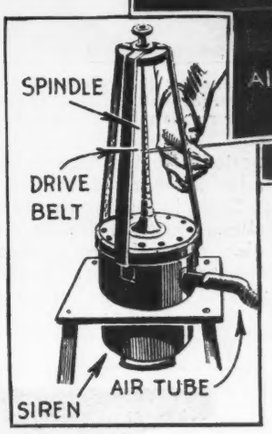
Hose and reel never become separated and after the hose is wound on the reel, the latter, together with the hose wound on it, may be put out of the way.

Siren Played by Sliding Drive Belt

THE strident notes of the siren have been musically tamed by a unique invention of Dr. A. R. Naber, of Holland, named by him "the magic flute."

In the ordinary siren the pitch of the musical notes is determined by the frequency of the impulses of compressed air passing through the openings in a rotating disk. But in the improved instrument the speed of this disk is arranged to be varied at will by an ingenious driving spindle, producing in the hands of an experienced artist all the tones and semitones of the flute.

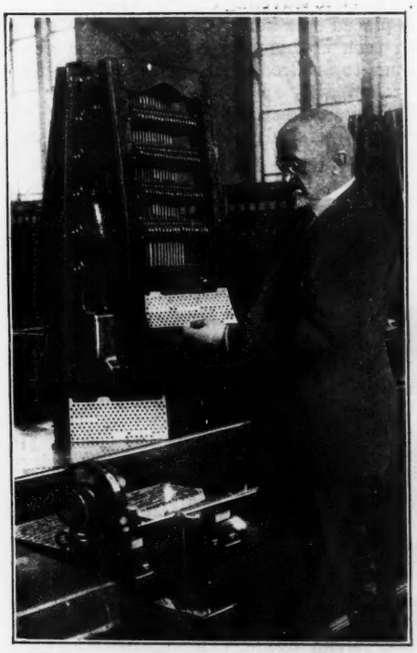




A full range of tones is obtained by sliding the string belt up and down the tapering shaft. The instrument is being tuned

The magic flute outfit consists of a small electric motor that drives the spindle of the siren disk by a flexible cord. While operating the magic flute, the cord connecting the spindle and motor is held between the fingers and altered in position as the score demands.

Perforated Cards Despatch City Fire Fighters



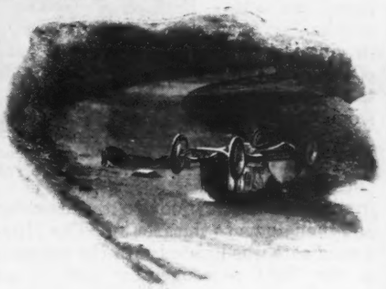
The perforated card and automatic despatching machine at "Central"

THIRTY-THREE seconds after an alarm is turned in, the fire fighting apparatus of New York City is on its way to the fire. In that short time with the aid of perforated cards the alarm is verified, recorded at the central office, and relayed to the engine house nearest the fire. The perforated card is the basis of the new system.

When the handle of the alarm box is turned, the box number is recorded visibly and audibly on a target in the central station. From an index box, the operator takes out a perforated metal card corresponding to the number of the box, places it under the despatching frame, which consists of a complicated arrangement of metal plungers and control switches, and throws down an electrically connected lid. As the plungers pass through the holes in the card, they signal all stations in that zone to be prepared for the second alarm.

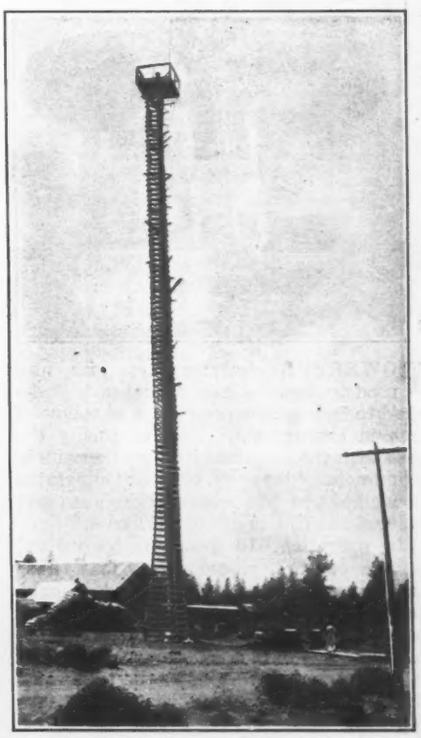
Photographer Snaps Car in Mid-Crash

FAST work with a camera enabled a photographer to snap the remarkable action picture shown below before the capsized car had ceased rolling. The camera had previously been focused on the turn in the road and the photographer, with unusual presence of mind, followed the skidding car with his lens and snapped the picture.



The pilot was still rolling when the photographer tripped the shutter

Every Step Adds a Mile to the View



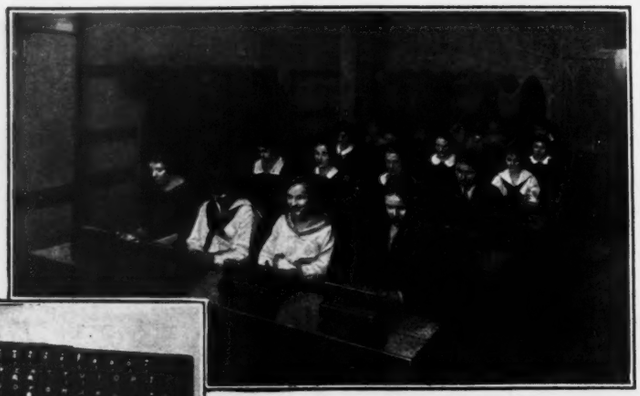
A fir tree forms the support for this 100-foot fire tower

AN ADDED mile of sight for every step is claimed for "the Sisters' Lookout," a forest fire station in the Deschutes National Forest, Ore. A frame of rough timber nailed to a fir tree forms a 105-foot ladder to the observation platform.

Speed Increased with Dummy Typewriter

A NEW typewriting machine, invented by Walter A. Butler and A. V. Cooper, of Troy, N. Y., is said to increase students' speed.

The arrangement of the keyboard is



By noting the relative positions of the lettered white disks, typewriting students visualize the words as a whole

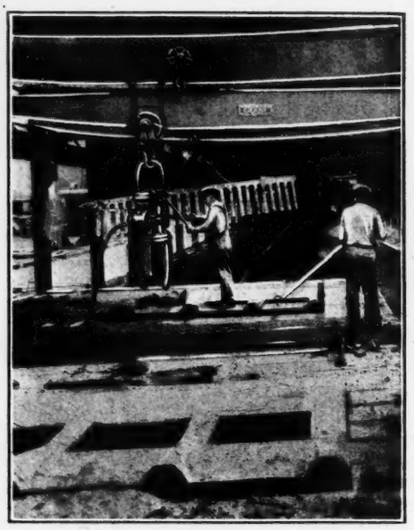
standard, but the keys are blank. Back of the keys are four tiers of letters. Above each symbol is a white disk connected with the dummy keyboard. As a key is depressed, the disk appears.

Thus, in making the word "the," the student receives the impression of three disks composing an acute triangle with the base uppermost. The student's brain retains the "shape" of the word.

Air-Hammer Breaks Ton of Pig Iron a Minute

A PNEUMATIC hammer is used for breaking up pig iron in an Alabama blast furnace. When molten iron from blast furnaces is allowed to cool in the pig or cast condition, the various pigs have to be broken up into single sections.

The equipment consists of an air hammer with a piston and striker of unusual size, and with valves and ports so arranged that a blow may be struck of sufficient force to break a pig into halves and sever it from the sow at the one stroke.

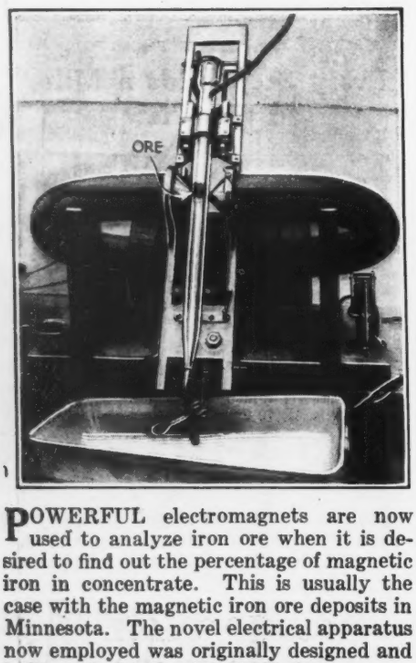


An air hammer working at 15 strokes a minute breaks up a ton of pig iron in the same time

It is used also for breaking up the sows. The cylinder is eight inches in diameter and the stroke 14 inches.

The hammer is suspended flexibly from an electric traveling crane. The bed of pigs is placed on a heavy cast-iron frame, which in turn is mounted on a platform above open-top railroad cars. When the pigs are broken, they fall through the openings in the frame directly into the cars. The hammer is operated by a hand-lever valve at a speed of about 15 strokes a minute.

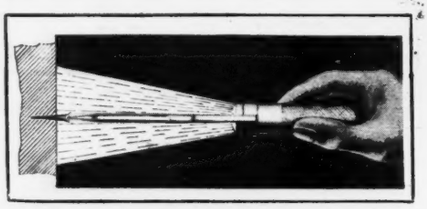
Powerful Electromagnets Now Assay Iron Ore



POWERFUL electromagnets are now used to analyze iron ore when it is desired to find out the percentage of magnetic iron in concentrate. This is usually the case with the magnetic iron ore deposits in Minnesota. The novel electrical apparatus now employed was originally designed and built at the University of Minnesota.

In operation, 10 grams of pulverized sample ore are placed in a glass tube, through which water flows under slight pressure. The tube is placed between the poles of an electromagnet. The current is turned on, and a powerful magnetic field is thrown across the center of the tube from the pointed extremities of the magnet. At the same time the glass tube is rocked slowly by a small electric motor.

The tube pivots on the pole pieces, with the result that all the magnetic ore is held in the center of the tube by the magnet, while the balance collects in the ends. When the washing and concentrating process is complete, it is easy to weigh and compute the percentage of magnetic iron ore in the sample.



Flashlight Illuminates Shadowed Work

HAND tools that supply their own illumination to facilitate the work being done have been brought out by a Mid-Western firm.

The complete toolkit is made up of the handle containing the battery and light source, three wrenches, and one screwdriver. The tools are of drop forged steel.

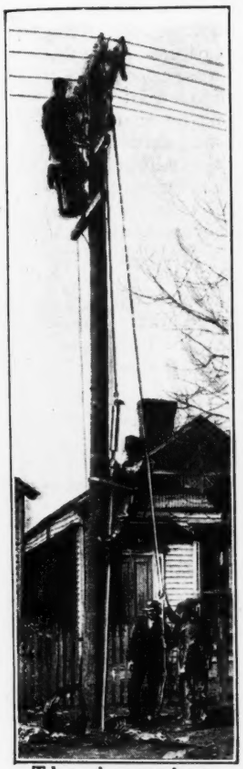
Auto Carries Record Load for Yeggmen

FINDING conditions in an office building of Los Angeles, Calif., unfavorable to safecracking, some robbers walked the streets until they found an automobile. Then driving it to the office building they parked it in front and proceeded to run the safe of an insurance company from the eleventh floor to the elevator and then down to the ground. The 1100-pound safe was hoisted into the tonneau of the light passenger car and carted several miles before the rear springs finally gave way. Out in the open country the robbers looted the safe of its treasure, and made a baffling getaway.

Although subjected to a terrific strain, this automobile carried the robbers and a half-ton safe many miles

It is surprising that springs designed to withstand only a few hundred pounds should have held up for miles under such a weight.

Pile Driver Hustles Pipe into the Ground



The dropping weight drives in the pipe

IN LOUISVILLE, Ky., the electric power and light company uses a portable pile driver for driving short lengths of pipe. It is said the device cuts the working time from two hours to 10 or 15 minutes.

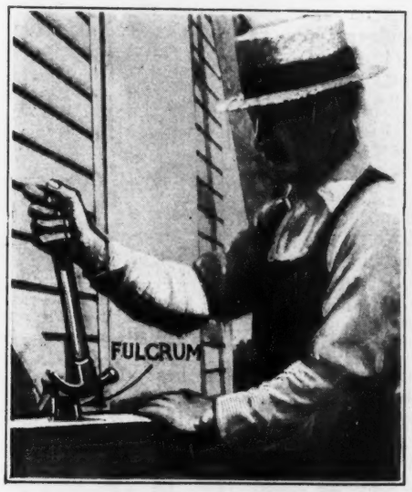
Before this pile driver was perfected, ground pipes were driven by a sledge in the hands of a man, supported by climbers on the pole.

The portable driver consists of an old piece of line shaft, about three inches in diameter and 18 inches in length, attached to a guide rod eight inches long, which enters a one-inch pipe without rubbing. At the other end an eyebolt takes a rope that runs through a sheave. When the weight is released, the impact drives the pipe from six to 12 inches into the ground.

Extracted Nails Are Almost "As Good as New"

BY EQUIPPING a hammer with an adjustable fulcrum that may be extended to any length within the limits ordinarily required in carpentry, J. A. Bartosz, of Salem, Ore., has invented a device that permits a workman to withdraw nails of any size without bending them.

The extension fulcrum consists of a rod with its lower end enlarged to provide a support. The position of the fulcrum can be readily changed.

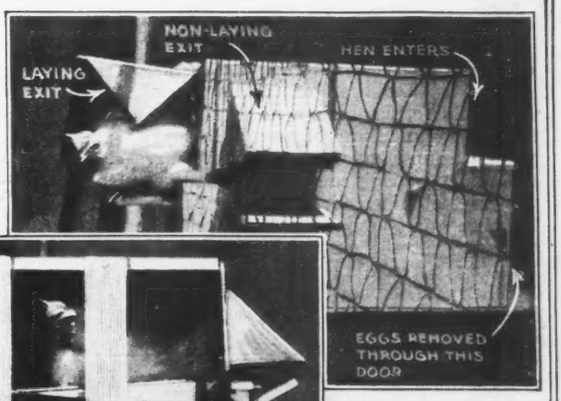


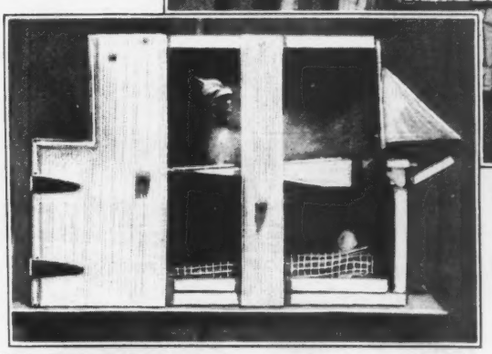
By adjusting the fulcrum on the hammer, nails are removed without bending

Trap Nests Betray Loafer Hens

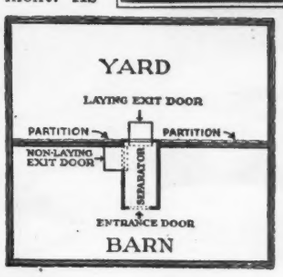
TRAP nests that work without springs have been perfected by three brothers of Sunnyvale, Calif., to separate laying hens from the loafers.

The nest consists of a box with an upper and a lower compartment and four doors. The hen desiring to lay enters from the back yard through one door into the upper compartment. As she squats on the nest, the door behind her is closed. If she lays an egg, the egg rolls down an incline into the lower compartment, where it operates a catch that opens a door in the front of the upper compartment. Through this door she steps down into a special yard. If she does not lay, she must leave through a side door. So the laying hens are in the special yard, while the non-layers remain in the back yard.





Each egg, as it is laid, operates a trap that automatically separates the laying hen from the loafer



The trap nest is set each morning. At night, hens that have laid eggs are in one yard, while non-layers are in another

© K. & H.

Inkstand Is Replica of Historic Gates

AN INKSTAND that is a miniature replica of the historic city gates of St. Augustine, Fla., is one of the latest gifts presented to President Harding. The original gates were built by the military governors during the Spanish occupation in the eighteenth century, and St. Augustine is proud of them, since they afford one more proof that she is the oldest city in the United States.

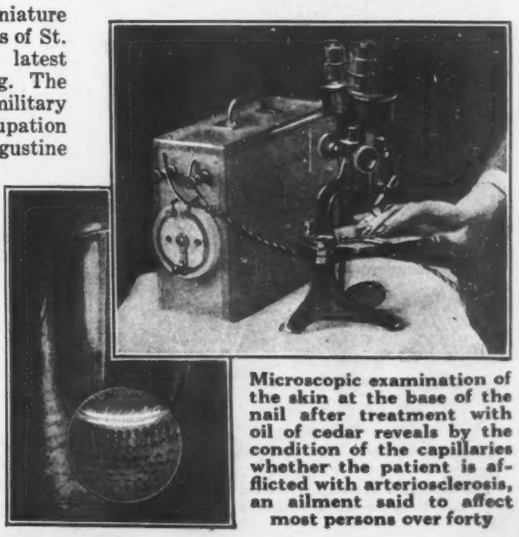
The inkstand is of silver, finished to imitate the age darkened adobe, or clay, of the gates themselves. This effect was obtained by a multitude of fine lines and a dark oxidized finish.

FOR the purpose of locating unknown lakes that may be the source of valuable water power, the Forest Service will soon take aerial photographs of all the national forest areas of Alaska.

Artery Trouble Detected at Base of Fingernails

HARDENING of the arteries can now be detected in its early stages by examining the skin at the base of the fingernail under a high-power microscope. Doctor Lombard, of the Mayo Clinic, Rochester, Minn., a prominent physiologist, recently discovered that when a drop of cedarwood oil is placed upon the skin and a small but intense electric light held just above it, the minute capillaries that form the smallest subdivision of the blood vessels, become visible under the stereoscopic type of microscope.

At the base of the fingernail the capillaries run parallel to the surface of the skin, and their course can be traced by means of the blood streams flowing through them.



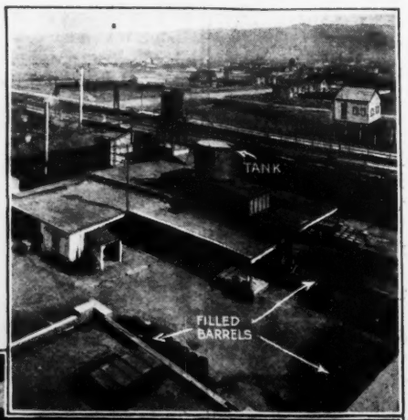
Microscopic examination of the skin at the base of the nail after treatment with oil of cedar reveals by the condition of the capillaries whether the patient is afflicted with arteriosclerosis, an ailment said to affect most persons over forty

Enormous Steam Heated Spout Speeds Asphalt Handling

BLACK paraffin or asphalt, composing about 80 per cent of the crude oil from which it is obtained during the fractional distillation of certain black oils of California, finds a ready market in the manufacture of varnishes and paints and in the preparation of roofing and road surfacing compounds, but the low price obtained for it calls for every bit of ingenuity on the part of the distillery to cut the cost of handling and shipping to a minimum.

When cold, asphalt is hard and brittle like glass; at moderate temperatures it becomes plastic; and above 160 F. it is more or less liquid and can be run through pipes. For transportation it is run into barrels or thin metal drums designed so that the container can be stripped off without difficulty, leaving the asphalt in a solid mass of the same shape as its container.

In one California distillery the asphalt is readily handled by a central supply system with a discharge pipe or spout that swivels to any part of the filling platform. The hot liquid asphalt is pumped into a tank on the roof of the filling station and is kept in liquid condition by steam heating coils. From the bottom of the tank the asphalt flows through a steam-jacketed pipe of large diameter to the filling department below.



One workman guiding the nose of the swiveling filling pipe fed from the storage tank shown at the right can fill hundreds of steel drums over the wide expanse of the filling platform

The Swivel Pipe

The filling pipe has two sections connected by swivel joints with a similar swivel joint connecting with the outlet of the storage tank. Lattice braces permit the sections to be moved in an extensive horizontal plane.

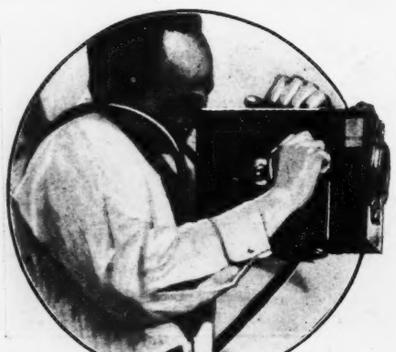
With the aid of this swiveled pipe one workman can fill 800 barrels or steel drums in an eight-hour day.

Creates Job by Using His Bicycle as Workshop

FINDING himself out of work and with meager assets, consisting mainly of a bicycle, a grindstone, and a few odds and ends, J. E. Anderson, a woodworker of Los Angeles, Calif., solved the problem of making an honest living by transforming his bicycle into a grinding machine.

He mounted the grinding wheel on the frame of the bicycle, so that its axle could be connected with the rear sprocket by a chain. A tripod, connected with a cord so that it could be lowered to the ground, formed a firm support for the bicycle when it was lifted off the ground and utilized as a grinder.

He escaped unemployment by rigging his bicycle as a scissors grinder



Camera Support Is an Aid in Photographing Planes

FOR studying the action of airplanes in flight, Anthony H. G. Fokker, the noted designer and builder of aircraft, uses a motion picture camera and a unique method of support.

When he found that it is practically impossible to photograph an airplane in flight with a motion picture camera resting on a tripod, because of the difficulty of adjusting the camera to the constantly changing angle of the object, he invented a supporting device that fits over the photographer's shoulders. With this suspension the cameraman can tilt the lens instantly to any angle and follow the movements of the plane through the finder.

The illustration shows the famous aircraft builder sighting at a flying airplane while turning the crank of the camera supported by his device.

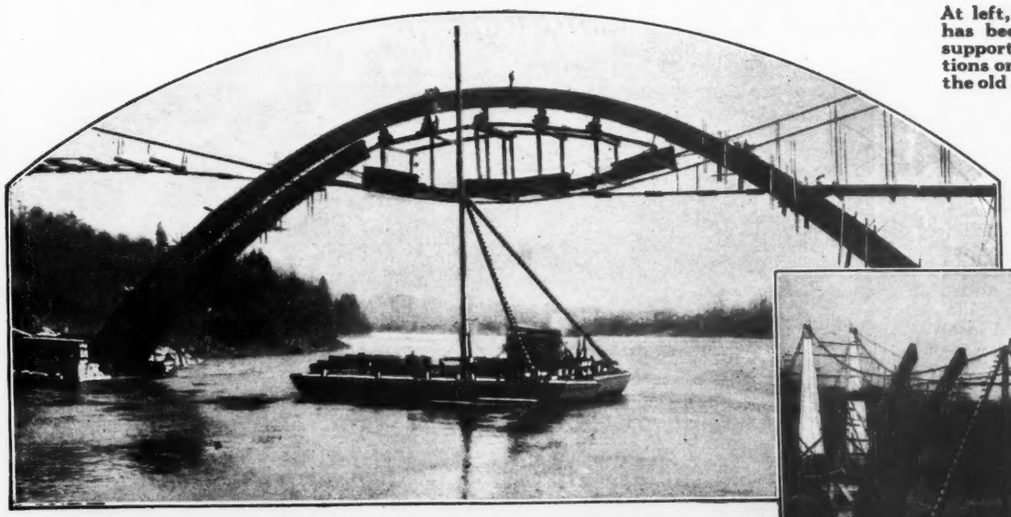
Some Secrets of Successful Dog Photography

RAW meat placed on the top of the camera is one secret of successful dog pictures. The dog must be persuaded to "watch the birdie" in various ways—by fixing his attention on some person, or on something moving at a distance, for unless the dog's attention is distracted, it will be apprehensive of the lens, and flinch when it hears the shutter click.

Meat between his paws makes him a good sitter

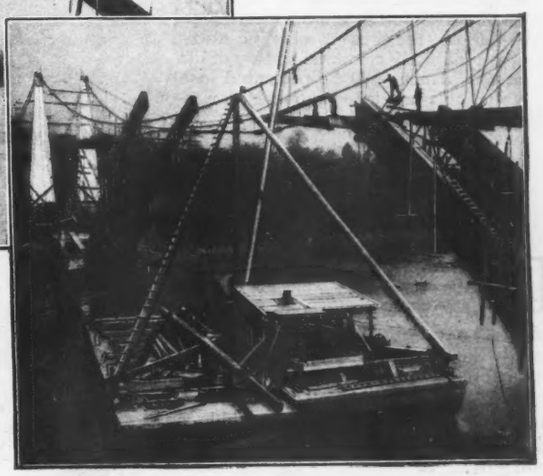
To photograph a dog sitting up and holding its fore paws together, which is the most difficult pose of all, the best device is to place a bit of meat between the toes of one fore foot and order the dog to sit up. A well trained animal will obey, but will be so afraid of dropping the meat before it can be eaten that he will hold it carefully and for a time become entirely unconscious of the camera.

Old Bridge, Doomed, Helps to Build Successor



At left, one side of span has been completed by supporting the top sections on timbers held by the old suspension cables

The method of tying back the side sections by means of cables lifted over the old towers is shown below



ALTHOUGH declared unsafe for traffic, the 33-year-old suspension structure over the Willamette River at Oregon City, Ore., proved to be indispensable to the engineers during the erection of the new 350-foot steel arch.

When the bridge builders were prevented from constructing the usual false work, by the great depth of the river at the bridge site and the intensity of water traffic, a scheme was devised so that when a section of the new arch had been swung into position, a cable was carried from it to the top of the tower and down to an anchor on the far side.

This procedure worked well with the side members, but the last six sections could not be supported in this manner. The engineers finally decided to use the old cable suspension as the support, although it was realized that the weight would approach the dead load limit of the ancient cables. But by working carefully and stripping away all nonessentials, the sections were lifted in place and supported in location with bridge timbers used as blocking.

As soon as the six top sections were riveted, the old bridge was torn down.

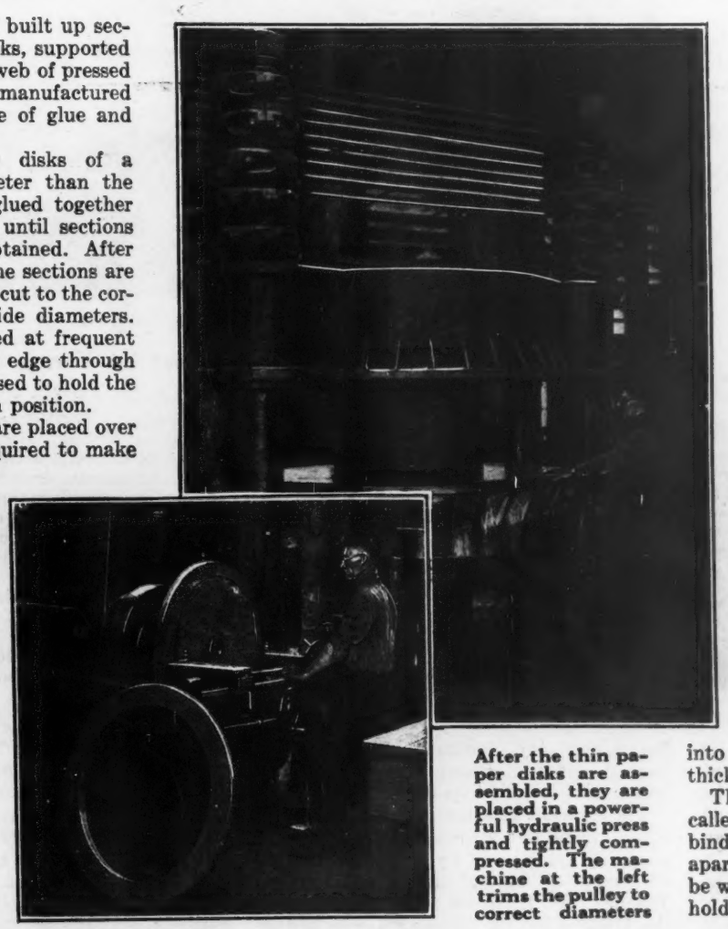
Hydraulic Press Makes Pulleys from Thin Paper Disks

PULLEYS made of built up sections of paper disks, supported in their centers by a web of pressed steel or cast iron, are manufactured by an interesting use of glue and high pressure.

First, thin paper disks of a slightly larger diameter than the finished pulley are glued together under high pressure until sections one inch thick are obtained. After a thorough drying, the sections are placed in a lathe and cut to the correct inside and outside diameters. Holes are then drilled at frequent intervals around the edge through which dowels are passed to hold the assembled sections in position.

As many sections are placed over the dowels as are required to make up the desired width and the mass is compressed in a powerful hydraulic press. The pulley is completed by inserting an iron hub in the center of the compact paper cylinder thus formed and trimming down the bearing surface to exact size.

Because of the fibrous texture of the end grain and the fact that this bearing surface is always being renewed as friction wears it away, paper pulleys are said to grip the belt better than metal pulleys, making it possible to allow plenty of slack in the belt.



After the thin paper disks are assembled, they are placed in a powerful hydraulic press and tightly compressed. The machine at the left trims the pulley to correct diameters

Brake Lining Is Tested on Subway Escalator

BRAKE linings that are compressed under a pressure of 1000 tons and woven and doped by a new process of manufacturing friction fabrics, have demonstrated phenomenal wear-resisting qualities in recent tests. A sample of the new product was recently placed at the foot of an escalator in a subway where 26,000,000 people walked across it. At the conclusion of this severe test, signs of wear were inappreciable.

The "dope," or compound, used to bind together the fibers of the fabric is largely responsible for the wearing qualities. These qualities are enhanced by placing brake lining material in a die press and shaping it to the finished form under a pressure that compacts the fibers and forces the material into a dense mass two thirds its original thickness.

The fabric is woven by a new system called "progressive weaving," in which the binder threads are placed some distance apart. This means that the top layer can be worn from a brake without reducing the holding qualities of the remaining material.

Did Germs from Other Worlds Bring Life to Earth?

Amazing New Theories about Living Conditions on Mars and Venus

THIS article concerns a great present-day debate among scientists over the "living conditions" on Mars and Venus, and over the question of where the life that has grown upon our earth first came from.

Far less a speculation, but equally fascinating, is the story of the evolution of life after it actually developed on earth. The actual known facts about evolution—the present scientific status of the infinitely romantic history of life on our planet—will be presented in a remarkable article forthcoming answering recent continuing attacks on the evolution theory.

By Scriven Bolton

Fellow of the Royal Astronomical Society

DID the earliest forms of life on our globe—the tiny parent organisms from which we, and all existing animals and plants have sprung—first reach Earth from some other planet millions of miles away in outer space?

Even to-day, are we being showered from breeding places on other worlds with minute bacteria that spread deadly plagues among us?

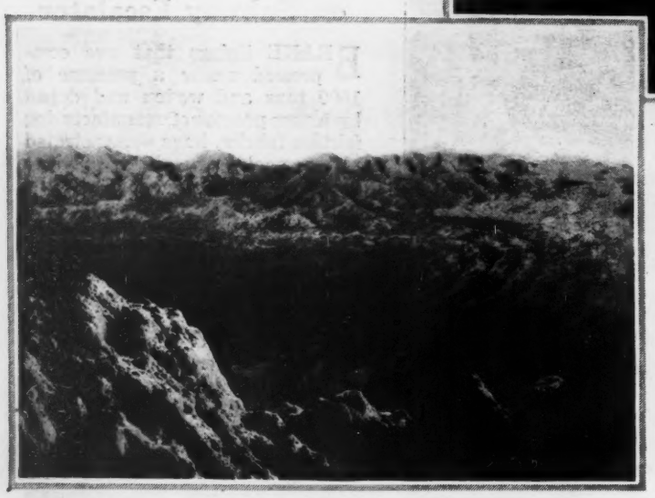
Instead of being a vast, sterile void, are the far reaches of the universe in fact alive with clouds of tiny "life germs," that drift about from planet to planet, borne by the rays of Sun and stars?

Interest in these questions—which are part of a fascinating theory made famous by the great Swedish physicist and Nobel Prize winner, Svante August Arrhenius—has been revived by a current discussion among noted scientists as to actual "living conditions" on other planets—especially Venus and Mars, our two nearest planetary neighbors, the former between us and the sun, the latter with an orbit just outside our own.

In the last published annual report of the Smithsonian Institution, C. G. Abbott, its assistant secretary, argues that recent astronomical evidence proves Mars to be lifeless, with an average temperature of 60 degrees below zero, and a climate drier than the Sahara.

Doctor Arrhenius has lately come to the same conclusion about Mars, believing it to be an arid desert of frozen sand, while Venus, on the contrary, may have a "soggy," cloudy atmosphere, ideal for the breeding of lower forms of life.

These recent assertions that Mars has an utterly frigid and airless climate have been promptly questioned by Prof. William H. Pickering, of the Harvard Observatory in Jamaica, W. I., world famous student of the Martian canals. While it is now widely accepted by astronomers that the so-called "canals" of Mars are not artificial streams of water, Professor Pickering declares they may well be bands of vegetation. He says, further, that the spreading ice caps seen about the poles of the great red planet are, in fact, frozen water, and not the deposits of frozen carbonic acid gas that other astronomers consider them to be. Professor

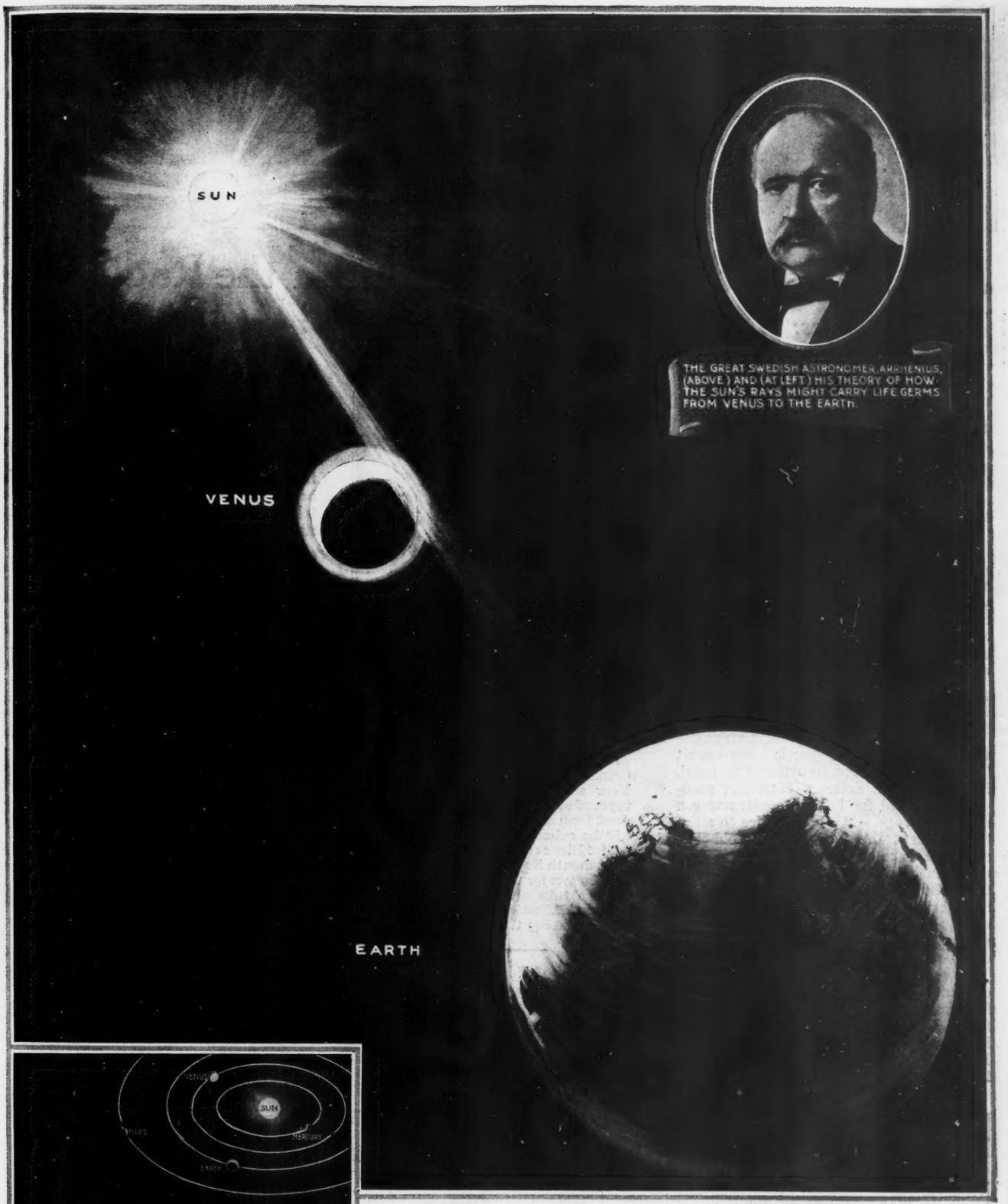


Illustrations © Popular Science Publishing Co., Inc.

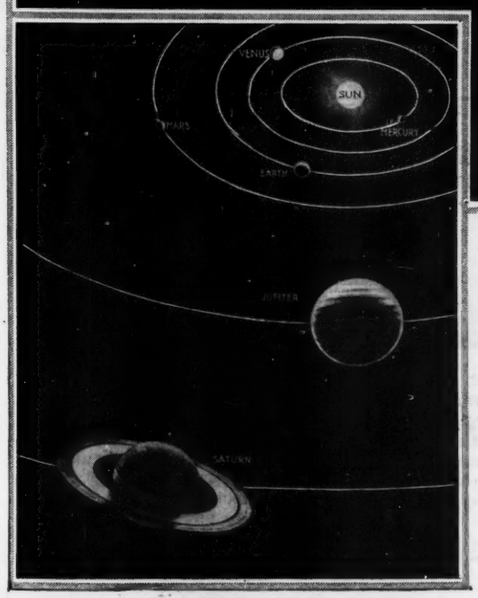
Typical Landscapes on Venus and Mars

ABOVE is a typical landscape on the planet Venus, as imagined by Scriven Bolton. The Venusian mountains, he says, are twice as lofty as our highest. Because the atmosphere has been supposed to be dripping with dense fogs and heavy clouds, followers of the famous Arrhenius theory believe that this sister planet of ours may be a universal breeding ground for lower species of life germs and for disease bacteria spores. The supposed atmospheric conditions would create an almost continuous exhibition of beautiful solar halos, as shown in the illustration.

The landscape of Mars, as typified at the left, is now supposed to be exactly the reverse. Ocean basins, such as the "sea" known as Syrtis Major, depicted in the imaginary illustration, are declared to be frigid swamps, while the continents are believed to be covered with dry frozen sand, in which life is utterly impossible



THE GREAT SWEDISH ASTRONOMER, ARRHENIUS, (ABOVE) AND (AT LEFT) HIS THEORY OF HOW THE SUN'S RAYS MIGHT CARRY LIFE GERMS FROM VENUS TO THE EARTH.



Illustrations © Popular Science Publishing Co., Inc.

How Sunlight Might Carry Life from Venus to Earth

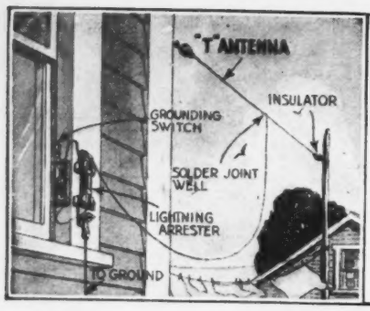
WHEN the planet Venus passes between Sun and Earth, according to Professor Arrhenius, rays of sunlight, pressing through Venusian atmosphere, might hurl into space countless particles charged with disease bacteria spores and animal and plant seeds. Some of these particles might ultimately reach Earth.

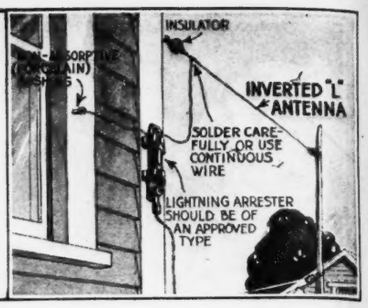
The picture at the left, showing relative positions of Sun and planets, illustrates Professor Arrhenius' theory that sunlight corpuscles may be the distributors of life throughout our solar system

Pickering brings forward, anew, technical evidence to show that there is water vapor enough on Mars to permit of some sort of vegetation, or other life, existing there.

While these two opposing theories about conditions of life on Mars are still being argued by astronomers of the utmost eminence, the theory that Venus —the planet nearest to Earth and very like it in size—may have an atmosphere

(*Continued on page 97*)




INSULATOR
INVERTED "L" ANTENNA
SOLDER CAREFULLY OR USE CONTINUOUS WIRE
LIGHTNING ARRESTER SHOULD BE OF AN APPROVED TYPE

Where a number of scattered broadcasting stations are within range, the "T-type" aerial (at left) is best. If only one good station is within range, the most efficient aerial is the "inverted-L type" (at right), with lead-in coming from the end pointed toward and nearest to the broadcasting station. Above, three steps in soldering ground to water pipe

Jack Binns' Ten Commandments for the Radio Fan

First Series: How to Get Better Results with Your Crystal Detector Outfit

By Jack Binns

A FAMOUS radio engineer of my acquaintance quite recently constructed one of E. H. Armstrong's super-regenerative circuits, and undertook a short series of experiments with it. At the conclusion, he summed up his opinion of the new system in these words: "It's no blankety-blank good!"

Now the fact is, of course, that the Armstrong super-regenerative circuit is not only good, but epoch-making. On the other hand, if a thoroughly experienced and competent engineer, who knows radio from A to Z, is unable to get satisfactory results with it, and gives up the attempt after a brief trial, just think how difficult success with it will be for the novice!

Novices Must Be Patient

In other words, at the present stage the super-regenerative receiver is not a circuit for the inexperienced to attempt to build. Many POPULAR SCIENCE MONTHLY readers have asked for help in constructing a set of this type. My best advice to all of them, except the most capable old-time amateurs, is to continue to make the most of present standard apparatus. There is no telling how long it will be before the super-regenerative circuit is refined by the engineers, standardized in commercial sets, and put out in such shape that the novice can easily operate it.

To make the most of the present highly efficient types of radio apparatus, certain fundamental rules and methods ought to be followed that can be most clearly presented in the form of "Ten Commandments for Radio Users." This month, I am presenting Ten Commandments for the crystal detector set, to be followed next month by Ten Commandments for the single circuit set, and thereafter by Ten Commandments for operating the feed-back circuit. No matter what type you are using, the following points about the crystal are fundamentally important to you.

JACK BINNS, America's most popular writer on radio, who writes herewith the first of his series of "Ten Commandments for the Radio Fan." Your successful operation of various types of receiving sets, and your enjoyment from radio broadcasts this winter will be enhanced if you profit by the advice Binns offers in this unique series. Next month he will give his Ten Commandments for using the single circuit vacuum tube set and in the January issue a third series of Commandments for operating the feed back circuit

The function of a crystal set is, after all, extremely simple. It is a valve that automatically cuts alternating current in two, allowing one half of the current to flow in the circuit attached to it, and stopping the other half of the current. The reason *why* the crystal is generally not good for more than about 25 miles in receiving phone broadcasts, while it will receive wireless telegraph signals over vast distances, is simple.

All Depends on the Power

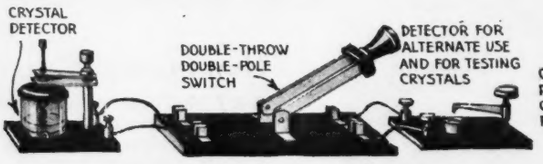
Everything concerned depends upon the power of the transmitting station. We rate this power in watts. Now, suppose a station has a rated output of 1000 watts—or, in other words, 1 kilowatt—so far as its carrier wave is concerned. If this carrier wave were used for interrupted continuous wave telegraphy, it would be quite possible for a crystal detector to receive the signals over a distance of 150 miles, under any conditions. But when this same carrier wave is used for the purpose of transmitting the voice or music, the distance is often cut down to approximately 25 miles. Why is this?

Because, in simple language, the amplitude of the wave used for telegraph code signals remains constant. The dots and dashes come in at the maximum of efficiency all the time. In the case of broadcasted voice and music, however, the amplitude varies over extremely wide ranges, according to the modulated output of the transmitter. This can be easily understood when you stop to notice the varying strength of tone and volume in different words and sounds uttered around you. In fact, some words can be heard and distinguished at greater distances than others.

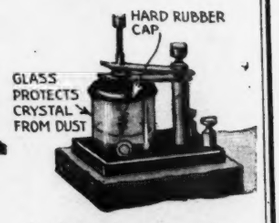
Now, with these fundamentals in mind,

How to Take Care of Your Crystal and Test Its Quality

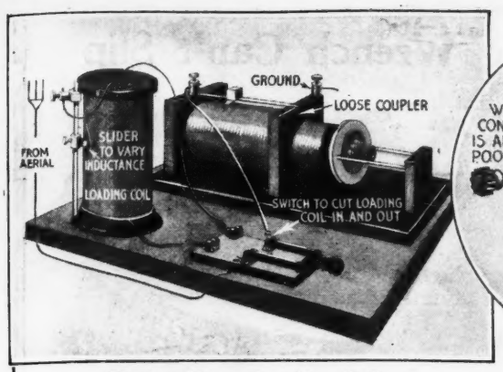
How to preserve and handle crystals to keep them sensitive. Don't hold them with your hands, but use pliers or tweezers



For emergency use or to test the quality of your crystal, attach it, with a second crystal, to a double throw switch, as shown above. The comparative merits of the two crystals can then be determined instantly by switching one of them out of the circuit and the other into the circuit

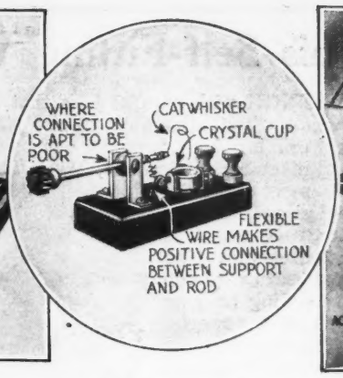


A glass cover protects the crystal from dust, while a firm rubber sponge under the detector unit acts as a shock absorber



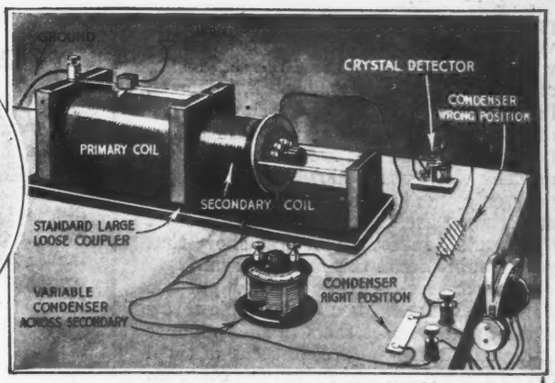
How to Use a Loading Coil

The loading coil which, in short wave reception, detracts from the efficiency of the set if left in the circuit, may be used to advantage in reaching longer wave lengths in the manner shown above. By means of a double-throw, double-pole switch, the loading coil may be cut in the circuit when long wave reception is desired


WHERE CONNECTION IS APT TO BE POOR
CATWHISKER
CRYSTAL CUP
FLEXIBLE WIRE MAKES POSITIVE CONNECTION BETWEEN SUPPORT AND ROD

For Good Connections

To insure good contact in ball-and-socket types of crystal detector, solder a light, flexible wire to the arm that holds the catwhisker, then solder the other end of the wire to the base of the holder



Where to Place Fixed and Variable Condensers

The correct position for a fixed condenser is in shunt across the ends of the telephone cord lugs, where it clears up signals in the circuit. Many radio beginners have placed the condenser in series with the detector and telephone. In using the desirable "double circuit tuner," shown above, a variable condenser should be shunted across the secondary

here goes for the Ten Commandments for Crystal Detector Users:

1. Do Not Use a Loop Aerial with a Crystal Detector. We have heard a lot of talk about hooking up a crystal set to a bed spring, a fire escape or a back fence. The sooner radio fans get these ideas out of their heads, the better their results will be. The crystal detector requires the best of aerials. It is possible, of course, for the amateur to receive radiophone concerts on a crystal with freak or loop aerials—provided he is near a broadcasting station. But for thorough enjoyment of all available broadcasts, the one best aerial is the "T-type;" and for reception on 360 meters this should have a flat top at least 150 feet in length. The lead-in should be soldered at the middle of this, and the aerial should be free and clear of all objects, the higher the better, up to 60 feet from the ground. This aerial is particularly good for the vacuum tube operator as well.

The user of the crystal detector set, however, should not employ this type of aerial unless there are a number of broadcasting stations within range of his set, and situated at different angles from him. If there is only one good station in which he is chiefly interested, the most efficient aerial will be the so-called "inverted L type," pointing toward that station. For this aerial the flat top should be as near 100 feet in length as possible. The lead-in should be a continuation of the aerial, and should come to the apparatus *from the end of the aerial nearest in direction to the broadcasting station it is desired to listen to.*

2. Do Not Make Your Ground Connection with a Gas Pipe. Gas pipes are insulated at certain points for protective purposes. The best possible connection that can be obtained is upon the water pipe. Do not rely solely upon a ground clamp to hold your wire to the pipe. Carefully clean the surface of the water pipe, and then solder your ground wire to it.

3. Solder All Connections Between the Various Pieces of Your Apparatus. Soldering is necessary because it makes a continuous electrical connection throughout the set, and reduces its total resistance. Every joint is like a little door, which, if not weather-stripped, will permit all sorts of drafts to filter through. If the connections of a radio set are not soldered, there will be, likewise, all kinds of little leakages.

4. Handle Your Crystal with Care. Do not, under any circumstances, take hold of it with your hands. If you do, you will leave a film of grease on its surface which will prevent you from finding a sensitive spot for reception. If it is necessary to move the crystal for any purpose, take hold of it with a pair of round-nosed pliers or a pair of tweezers.

Make sure that the crystal is securely fastened in its holder. Cover the holder and crystal with some moisture and dust-proof material. Do not forget that if you are using galena as your crystal, the catwhisker should only just touch the surface of the crystal. Under no circumstances should pressure be applied to it. This is very important. The contact should nevertheless be firm, so that slight vibrations will not jar it from its position.

If possible, mount your crystal detector unit on a shock-absorbing device. Try heavy, resilient rubber, a firm rubber sponge, or even corrugated cardboard.

Be sure that the movable parts of the crystal holder are making good electrical connection at all times. Most of the movable parts are made on the ball and socket

The World's Most Powerful Vacuum Tube

PERFECTION of the most powerful vacuum tube in the world—the 100-kilowatt giant just produced by engineers of the Bell laboratories—is undoubtedly the outstanding radio development of the month. One of these tubes would be sufficient to maintain constant wireless telegraph communication across the Atlantic Ocean, while four of them, joined in parallel at the gigantic transatlantic wireless stations, should permit continuous telephone conversations between New York and European capitals under all conditions.

Difficult Problems Solved

At first glance, it may not seem remarkable that such a powerful tube should have been developed, but experience has demonstrated that when the output of an ordinary vacuum tube is extended beyond one kilowatt, a series of practical difficulties arises, and among them are the problems of cooling the tube so that it can be kept in continuous operation, and also of maintaining the vacuum.

In the new tube, these difficulties have been overcome. The metal has been sealed to the glass, so that a variation in temperature ranging from that of liquid air to more than 300 degrees above zero, Centigrade, fails to sever their connection, or break down the vacuum of the tube.

Another unique feature is the system of water cooling. The plate of the tube is on the outside of the glass, but sealed to it. It is the long, dark-colored metal cylinder shown in the above photograph. In use, this plate rests in a deep socket, where water is circulated to keep the huge tube cool. Grid and filament are inside this cylindrical plate.

Here is the new 100-kilowatt vacuum tube in the hands of W. G. Housekeeper, who was largely responsible for developing the water cooled tube in the Bell laboratories

Not only does this new development offer immediate opportunity to bring about reliable transatlantic telephone conversation, but it brings the day nearer when we may replace with such tubes the ponderous and costly alternators now used for long-distance wireless communication and those used for power transmission, as well.

principle, and a loose connection there is a very common thing. If you are in doubt whether the arm that holds the catwhisker affords a good electrical path, solder a light, flexible wire to it, and then solder the other end of the wire to the base of the holder, where the arm is fastened. It may not look nice, but it will materially increase your enjoyment. Many times, when you are vainly searching for a sensitive spot on the crystal, investigation will show that your trouble lies in this movable arm.

If you are mechanically inclined, put two crystal detector holders on a double throw switch, and connect them in such manner that you can instantly switch one of them out of the circuit, and switch the other in. Thus, if you are in doubt about the quality of the crystal you happen to be using, you can quickly test its merits with the other crystal.

5. Don't Bow Down in False Worship to Galena. The lead that galena enjoys over other crystals in the matter of sensitiveness is more than overcome by its susceptibility to vibration. The slightest jar will loosen its contact from the sensitive point, and a considerable portion of the concert may be lost entirely, while you are searching for another sensitive spot.

Silicon, while not so sensitive, is much more rugged. The so-called Perikon detector, composed of two crystals making contact with each other, is almost as good, and less troublesome than galena. It will pay you, also, to try out carborundum. With this crystal the contacting arrangement can be screwed tightly on the crystal, so that even the heaviest vibration cannot shake it loose. However, in using carborundum, it is necessary to add a small potentiometer to your circuit, and use a dry cell, so that a low voltage can be placed on the crystal.

6. Treat Your Telephones with Consideration. Do not forget that the telephone is one of the most delicate and sensitive of all inventions. It will respond to currents which are far too small to actuate other common apparatus. With a crystal detector you cannot get results from a 75-ohm telephone, such as is used by the telephone companies. Your telephones should have a resistance of at least 1000 ohms. But remember that the resistance of a telephone is no guide to its sensitiveness. In radio, telephones are rated by the direct current resistance of their coils for the sake of convenience only. In these telephones it is necessary to have a large number of turns in the coils about the magnets, in order that the feeble currents that pass through them may actuate the magnets sufficiently to vibrate the diaphragms, and consequently it is essentially the number of turns and efficiency of the winding that determine the telephone's efficiency.

7. Do Not Overload Your Tuning Circuit. Remember that in using a crystal detector your range is extremely small, and consequently it behooves you to do everything possible to get the maximum results out of your set. If your aerial tuning inductance has a large number of turns, it will cut down the efficiency of your receiver, unless in some way the "dead" ends—or, in other words, the unused portion of the tuning coil—are short-circuited.

I find that a great many radio fans think a loading coil added to their tuning inductance will, in some mysterious manner, increase their range. This is an unfounded assumption. Loading the inductance of a receiving set merely helps it reach longer wave lengths than those for which it was originally designed. A loading inductance, when left in the circuit while the circuit is being used for short wave reception, detracts from the normal efficiency of the set.

8. Don't Commit Assault upon the Circuit with Fixed Condensers. The only place for a fixed condenser is in shunt across the ends of the telephone cord lugs. There it forms a by-pass for the high-frequency currents which manage to escape past the crystal, and helps to clear up the signals in the circuit. Do not forget that all inductances in the form of coils have distributed capacity in their windings, and unless you place a variable condenser in the oscillating circuits, you will not be improving your results to any appreciable extent. Capacity is very necessary in oscillating currents, but it must be carefully balanced.

Quite a number of radio fans who have been in trouble with crystal sets have sent me their wiring diagrams, and in many cases I have observed that they have placed a fixed condenser in series with their crystal detector and the telephones. This reduces the efficiency of the circuit.

9. Let Your Radio Waves Travel Only the Straight and Narrow Path. This commandment is laid down particularly for those fans who construct their own receivers. Do not place your telephones in shunt across the crystal. The only place for the telephones is in series with the crystal and the return lead to the tuner.

10. Learn How to Use Your Tuner Properly. Remember that the double circuit tuner is far better than the single circuit, in cases of interference, which it will not entirely eliminate, but will materially reduce.

By a "double circuit tuner" I refer to a loose coupler, or variocoupler. With such a circuit there are three tuning elements, and the best results are obtained when all three are properly adjusted. First, there is the primary circuit, which consists of the primary winding of the coupler in series with the aerial and a variable condenser. Next, the secondary winding of the coupler, which should have a variable condenser shunted across it. And then the variation of the coupling between the primary and secondary coils of the coupler.

If you use a variocoupler, do not expect it to function perfectly without a variable condenser across it. Remember that the windings on the secondary of this instrument are not tapped in any way, and therefore cannot be varied; consequently, the variable condenser is absolutely necessary, in order to tune up the secondary circuit into resonance with the incoming signal.

This Self-Fitting Wrench Can't Slip

A WRENCH with parallel jaws that is instantly self-adjustable to the size of the work has been brought out by a tool manufacturer in Baraboo, Wis. The wrench is made in 10 different sizes to accommodate work up to 4 inches in diameter. The principal feature of the tool is a sliding fulcrum that insures a powerful grip by causing the force of the lever to be exerted close to the load.

To use the wrench, the handles are spread apart and the jaws slipped over the work. As the handles are brought together, the fulcrum slides toward the work until the jaws are parallel. By providing this unusually long leverage, the work once gripped is held tight until released.

A flattened surface on the back of the wrench serves as a convenient hammer and one of the handles is sharpened to form a screwdriver.

Long leverage and tight grip are advantages of this new wrench

$50 in Prizes for Interesting Photos

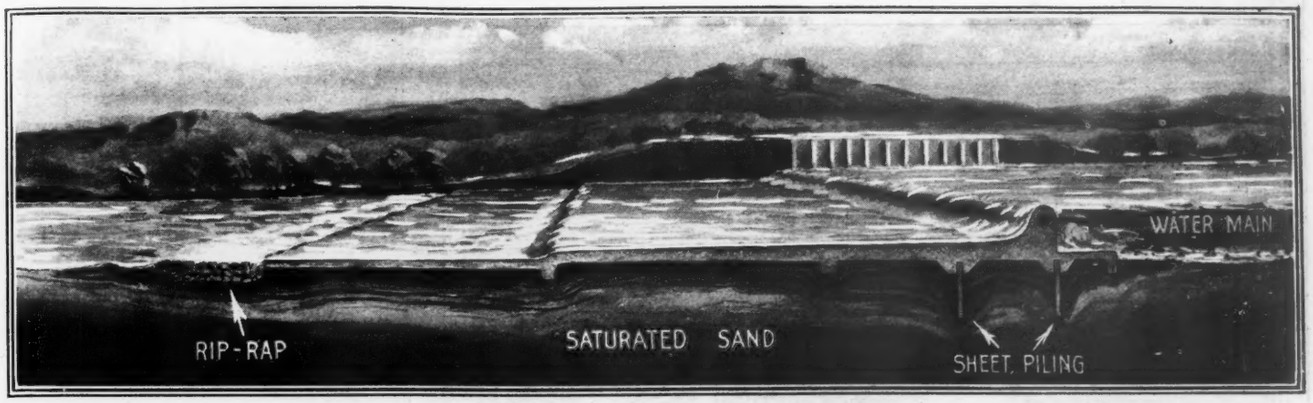
TWO remarkable photographs combine to tell a fascinating story of engineering resourcefulness—a story of how an old, condemned bridge across the Willamette River in Oregon was used as an indispensable aid in the erection of a new steel span—and win the **FIRST PRIZE** of $25 this month in POPULAR SCIENCE MONTHLY'S $500 camera contest. The first prize-winner is **Ralph J. Eddy** of Oregon City, Ore., and the photographs appear on page 39 of this issue. Other prize-winners are:

SECOND PRIZE, $15—Felix J. Koch, Cincinnati, Ohio. Subject: "Engine Winds Circus Tent on Spool" (see page 54).

THIRD PRIZE, $10—Miss Dora Gross, Memphis, Tenn. Subject: "How Detachable Reel Holds Hose without Kinking" (see page 35).

THE monthly camera contest will be concluded with announcement of prize-winners in the January issue.

Tiny Trains Aid Engineers in Race with Flood



Completed, the dam "floats" on saturated sand over a wide apron of concrete slabs. Sheet piling at the upstream end anchors the structure and prevents underscouring. In the background are the sluice gates through which water passes to an irrigation canal

RACING against time in a long-odds attempt to complete a floating concrete dam across the Gila River in Arizona before floods set in, engineers of the United States Indian Bureau finished the work recently, just seven days before the torrents poured down the river bed. The dam, although of a type not previously tested, withstood the tremendous pressure so successfully that other floating dams probably will be erected where embedded dams are found unsuitable.

Usually, in preparing a dam site, excavations are made to "hard pan;" but probes at the Gila location failed to touch solid bottom. It was decided to design a dam made of concrete slabs resting on the fine-sand river bed with precautions taken to prevent the underflow from lifting the dam and carrying it away. This called for sheet piling and an anchorage on the upstream side and a long tapering apron on the downstream side.

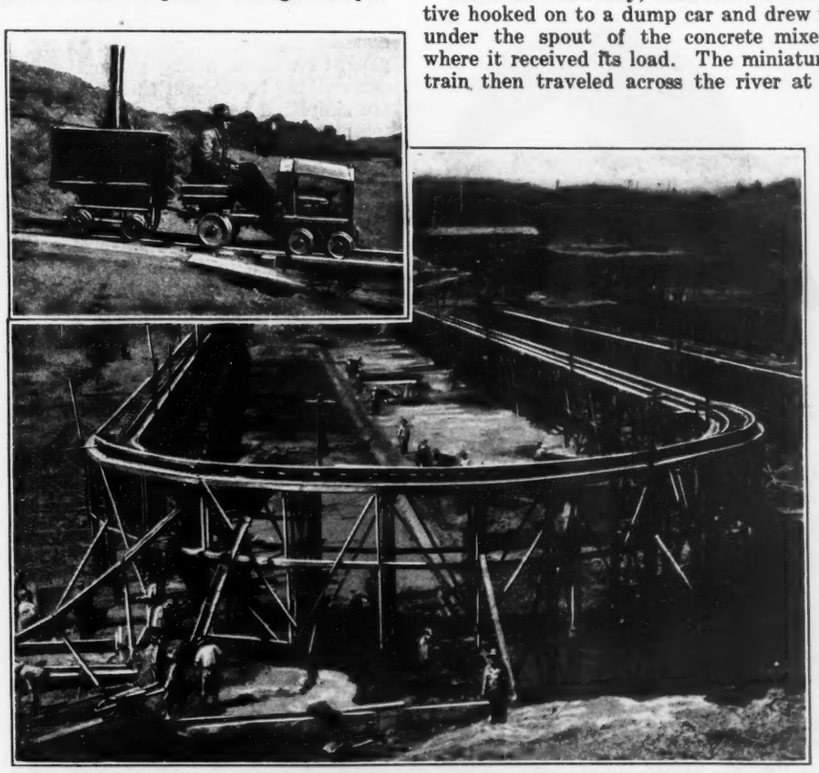
The dam, as finally completed, consists of a spillway 15 feet high and 400 feet long, with a concrete slab apron extending 212 feet downstream. A cement flume 42 inches in diameter passes through the spillway from one end to the other to supply a canal on one bank. Two rows of sheet piling were driven into the subsoil under the fore part of the dam to check the underflow. At the extreme lower end an area of rip-rap was laid to prevent undermining.

That the construction of the dam was completed in the short time available before the floods came rushing down the river, was due to the ingenious system of tramways and dump cars devised by the engineers in charge.

Two elevated railways carrying narrow gage tracks and in the form of narrow ovals were built out into the river, and a concrete mixer was placed above the track at one end of each oval. Motive power was supplied by stripping down four small automobiles and replacing their rims with flanged wheels.

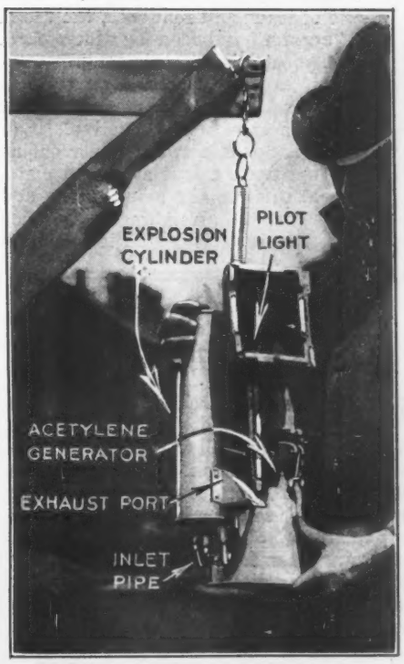
When all was ready, each little locomotive hooked on to a dump car and drew it under the spout of the concrete mixer, where it received its load. The miniature train then traveled across the river at a surprising rate of speed to the hoppers down which the liquid concrete flowed to the slab forms. The trains made a round trip every six minutes and although the load each trip was not extraordinary, the total quantity of concrete that was handled taxed the capacity of the big mixers.

With the completion of the canals fed by the water of the Gila dam, the Government has reclaimed 62,000 acres of land.



Tiny improvised locomotives (inset) sped around oval tracks, built across the river bottom, carrying concrete from mixers to forms as the floods gathered higher up the river

Trout Guarded from Birds by Explosive Lantern



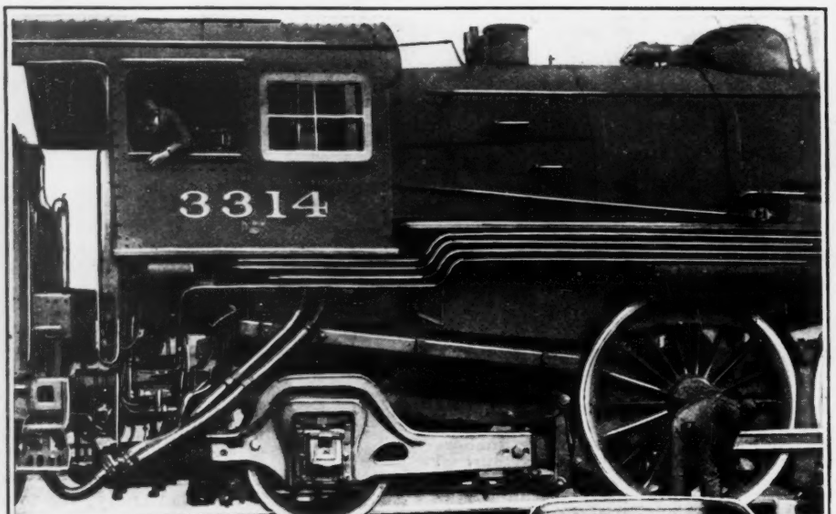
THE manager of a trout farm, on the outskirts of Salt Lake City, formerly lost many fish through depredations of herons and cranes, which made a practice of visiting his ponds during the night.

Now the trout are protected by an explosive acetylene lantern that goes off with a bang every 15 minutes. The cost of operation is less than 15 cents a night.

The larger vertical cylinder is the generator, with a two-quart water tank at the top. The carbide is placed in the lower chamber, where the slowly dripping water produces the gas.

The smaller cylinder is the explosion chamber. A small pipe, with an air inlet to modify the density of the gas, connects the two. Another tube supplies a pilot light, which periodically fires the acetylene in the explosion chamber through a vent.

Booster Helps Locomotive Make Grades

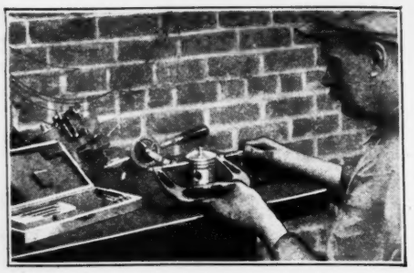


The "booster" attachment is shown above in its position over the wheel of the trailer truck, directly under the engine cab and back of the rear drive wheel. At right: Two pistons working through gears convert trailers into driving wheels

BECAUSE the advanced types of locomotives are approaching the weight limits of track and roadbeds, the use of the "booster" is becoming wide-spread.

The booster is a supplementary driving unit exerting its force on the idle trailers and utilizing them to aid the tractive effort of the locomotive.

The booster is a two-cylinder engine supported upon a cast steel bed plate, which also forms the axle bearing and truck support. Weighing only 3500 pounds, the booster is said to add from 25 to 40 per cent to the locomotive's pull. It is controlled by the standard throttle, and when the engine reaches road speed is automatically disengaged.

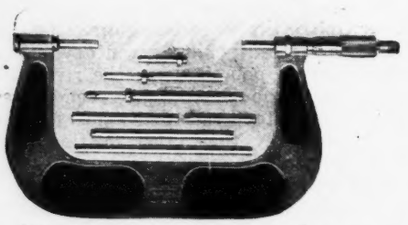


Micrometer Caliper Has Four Inch Variation

BECAUSE of the increasing number of small pistons on automobiles, a new micrometer caliper that will take measurements from two to six inches has come into wide use.

The four-inch variation is made possible by four interchangeable anvils furnished with each instrument. Each anvil is held in place by a knurled nut.

The shape of the micrometer frame adapts it to all kinds of work and makes the instrument an easy one to handle.



Insertion of the proper anvil in the tool shank provides a micrometer that will measure diameters from two to six inches

Six-in-One Auto Gage Worn as Watch Charm

NUMEROUS jobs around the automobile, such as setting valve tappets, distributing head points and spark plug gaps, as well as fitting piston heads and determining the correct thickness of shims, are simplified by a special six-in-one gage recently perfected.

The gage consists of six blades varying in thickness from .0015 inch to .015 inch and arranged in a common holder so that any of them may be used in combination to measure distances up to .0315 inches. An eyelet punched in the holder permits the owner to wear it on a handy chain if desired. Although accurately ground to size, the gage is ruggedly made.

This thickness gage, with its six blades, will make accurate measurements up to .0315 inches

Battery Frozen in Block of Ice Is Unharmed

FROZEN inside a solid block of ice, a dry battery of new design recently drove an automobile through the streets of Denver, Colo., for five days. Special plates, a special separator, and a secret formula for the electrolite are given by the inventors as the explanation of this unusual feat.

Following the freezing test, the battery was completely discharged, and after a few moments' rest, was recharged again by the use of the car's generator.

© Ewing Galloway

This test was devised to show resistance of battery to winter temperatures

Pocket Adder Calculates in Millions

SUMS up to nine million dollars may be added on a new pocket calculator only five inches long, 3½ inches wide and half an inch thick, and selling for only two dollars. The miniature machine will add or subtract as conveniently as any of the larger machines.

The calculator consists of nine rows of figures with a sliding slot beside each. To add, a stylus inserted in the slot opposite the number, is pushed upward. The next number is treated in the same manner, except that in case the indicator opposite the number shows red, the stylus is pushed down instead of up.

Designs Concrete Arches with Microscope

Scientist Invents Method of Using Frail Paper Models to Test Strength of Complicated Engineering Structures

THE skyline of America would reveal many more attractive concrete structures if engineers, instead of adhering to the staid and limiting processes of mathematical analysis, would make wider use of a new mechanical method of studying concrete buildings, according to Professor G. E. Beggs, of Princeton University. Professor Beggs' statement is based on results of tests obtained with a simple apparatus of his own invention in which he uses models of structures of which the theoretical characteristics were already known.

Paper Model Structures

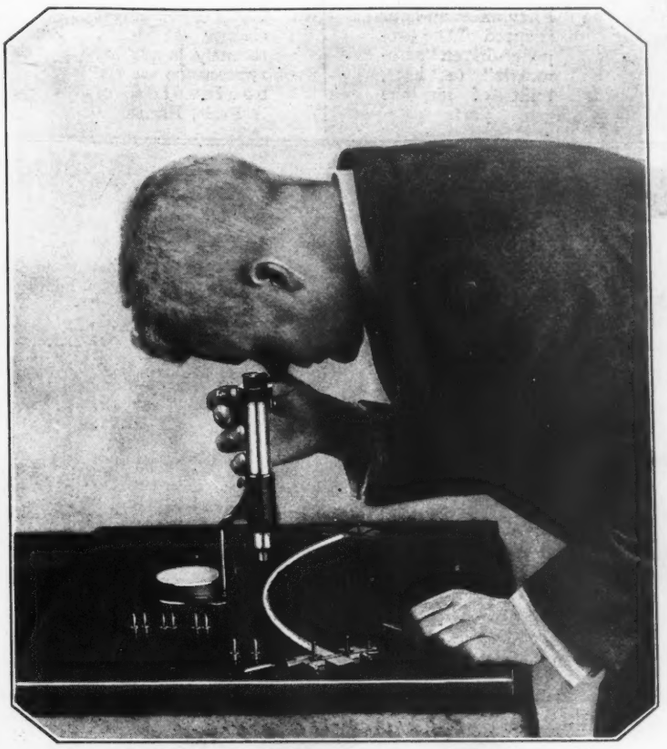
The layman can hardly appreciate the immense amount of careful computation that is required from the designing engineer for even the simplest of concrete arches. Recognizing this drawback in solving so-called "indeterminate structures," Professor Beggs has worked out a method of microscopical measurements, employing celluloid or paper models that duplicate perfectly the behavior of actual structures.

The device is based on the action of a lever suspended at a point other than the center and weighted with a known weight at one end. By measuring the distance that the weighted end goes down and the corresponding distance that the free end moves up, it is possible to find the exact weight that must be added to the free end to balance the lever.

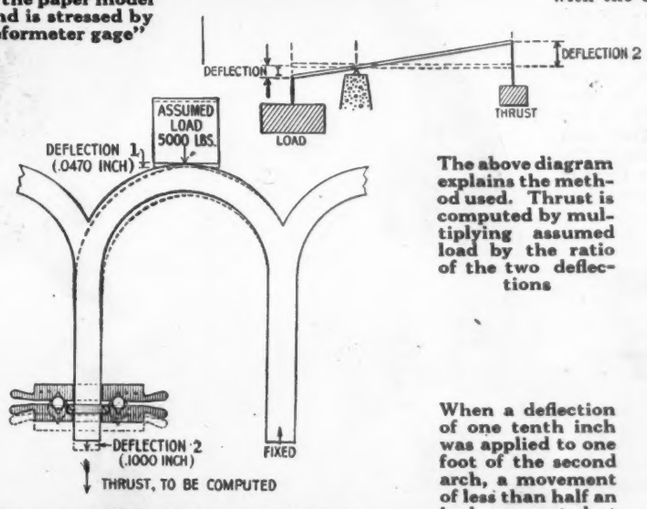
How the Model Is Set Up

When the characteristics of a complicated structure are to be determined, Professor Beggs cuts a small model from celluloid or paper, with thickness and length carefully proportioned to the original. This model, supported by bearing balls, is placed on a flat drawingboard. Various attachments are added to the model, depending on the type of structure and on the data desired. In the case of a single arch where the designers wish to know about the strains at one end of the arch when different types of loads are applied, the other end is fastened to the drawingboard, just as it would be if the arch were supported on its abutment. At the free end, a small device called a "deformeter gage" is fastened.

The deformeter gage consists of two parallel metal bars four inches long and .4 inch wide, arranged so that one is fastened to the drawingboard by steel pins and the other allowed to move freely. The end of the model structure is fastened rigidly to the movable member. At each side of the center line of the two bars a V-shaped cut receives gage plugs. There are five sets of these gages. Two sets, consisting of short rods arranged in pairs of two different sizes, are for measurement of thrust, which is the force with which the bottom end of a structure presses against the abutment or foundation. The third set is made up of two rods of different sizes and is used to measure the "moment," the term employed by engineers to describe the tendency of the structure to bend, due to a force applied somewhere along its length.



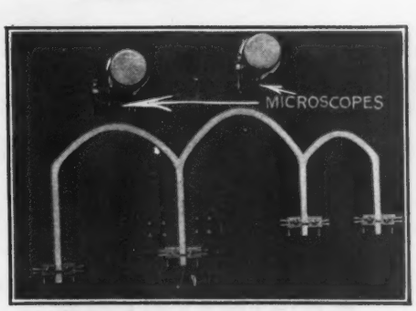
Above, Professor G. E. Beggs, inventor of the time saving system, measures with a microscope the movement of a point on the paper model as one end is stressed by the "deformeter gage"



The above diagram explains the method used. Thrust is computed by multiplying assumed load by the ratio of the two deflections

When a deflection of one tenth inch was applied to one foot of the second arch, a movement of less than half an inch was noted at the top

The test pictured below is explained in the diagram above



Professor Beggs' equipment consists of a paper model, a microscope, and necessary deformeter gages

Microscope Measurements

The final set of gage plugs is for shear stresses. If one end of the footing is held rigidly and a load applied to the structure, there is a tendency of the member to slide off horizontally. This is called "shear." The shear gages are rectangular rods that fit into the V groove in the bars.

After this deformeter gage is in place, the micrometer microscope is set up over the point on which the load is to be applied. The field of the microscope is turned so that the cross lines on the field agree with the direction of the loading. Then, to measure the thrust, the normal plugs that are kept in the gage during the setting up process are removed and the set of large plugs substituted. The point on which the microscope was originally trained is found to have moved. The new point is noted. Then the plugs are removed and the smaller set is substituted. Further examination reveals another movement of the load point. Since the microscope used by Professor Beggs reads to 1/16,000 of an inch, these movements can be read accurately.

The computations that follow are simple. The dimensions of the plug gages are selected so that the movement caused by their insertion is of a known amount. Combining this figure with that obtained from the microscope reading, the result is a ratio determining the pressure on the foot of the arch, caused by one pound of load applied at the top.

The total pressure at the footing of the arch is then computed by multiplying this ratio by the total load that the arch should be designed to withstand.

A Page of Novel Photographs from the News of the Month

An Aeromobile

Fifty miles an hour is speed of the propeller-driven "aeromobile" (at left), built of airplane parts

Paris Road Brush

The tricycle street cleaner (at right), recently made its appearance on the boulevards of Paris, France

"Gib's" Rain Catchers

Sheets of iron, laid over the sloping sides of the Rock of Gibraltar in the Mediterranean, like a tin roof on a house, act as "rain catchers" to provide water supply for the great rock. The rain drains into gutters at the bottom and from there is pumped into reservoirs

© M. Flandrin

Just like Tin Roof

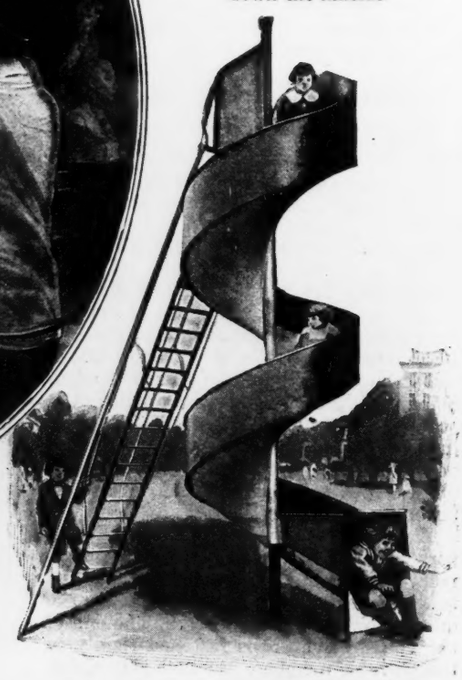
Lack of water has been one of the chief drawbacks of Gibraltar. Because of the porous nature of the rock there are no springs. For the same reason, iron sheets were necessary to prevent the rain from filtering through the rock as it poured down the hillside

This Colorado naturalist displays two cherished possessions—a porcupine's skin and old overalls with wasp nest "built in"

Courtesy *Edison Monthly*

Power Tool Aids Sculptor

Compressed air tools are replacing the hand mallet and chisel. The tool shown above derives its power from a small gasoline engine and air compressor in the studio. Not only greater speed, but finer work is possible with the power tool, it is said



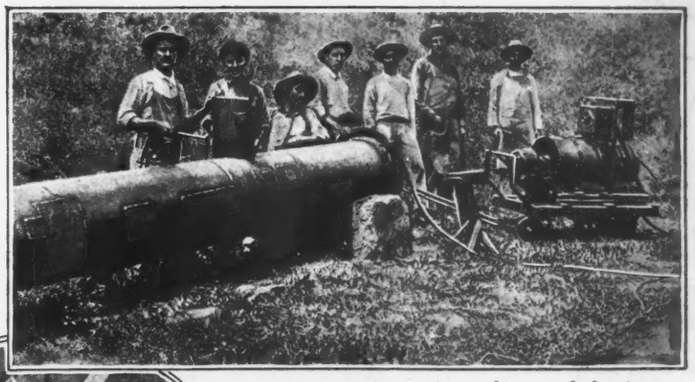
This all-steel spiral slide, with two complete turns, and a sliding distance of 35 feet, is proving popular

Steel Patches Mend Rusted Pipe Line

PATCHES of steel plate, applied like plasters to weak spots and securely welded in place, recently effected repairs to a 3000-foot water pipe line in Honduras, South America, saving the cost of rebuilding the entire line.

This 22-inch pipe line, which supplies the Guadalupe plant of the Honduras Rosario Silver Mining Company, had been in service for many years. During that time most of it had lain on top of the ground, and was badly corroded. Examining the sections previous to the start of the work, the engineers discovered places where the sheet steel had been rusted to the thinness of ordinary paper.

The line was constructed of one hundred 30-foot sections riveted together in 90-foot lengths, equipped at the ends with connecting flanges. Removal of the corroded sections was not advisable because of the weakness of the riveted joints, while the rugged nature of the country made transportation of new pipes for replacement an extremely expensive undertaking. It was finally decided to make repairs by the use of portable electrical arc welding outfits manned by native workmen.



Below: Welding a steel patch on a section of pipe under a protective awning

Above: A section of corroded pipe, showing numerous steel patches welded over weak spots by the portable welding machine shown at right

How the portable arc welding equipment, weighing 1500 pounds, was hauled over the mountainous country of Honduras, South America, to repair the pipe line

Patching Saves Expense

First, the pipe line was disconnected at every third joint, so as to leave 90-foot sections of continuous pipe in each piece. These sections could be easily turned around on the tiers on which they were originally stalled. Engineers examined every inch of the pipe and marked the weak spots. Then at each weak spot a piece of steel plate of the proper size was formed to cover the marked area. Around the edge of this plate the welders deposited a fillet of metal, producing a tight, tough joint.

After the work was completed, the pipe line was tested with double pressure. Only a few leaks appeared, and these were promptly closed with blows of a calking hammer. It is estimated that the repairs were made at one tenth the cost of replacing the entire line.

Talking Machine Phones Height of Water in Reservoir

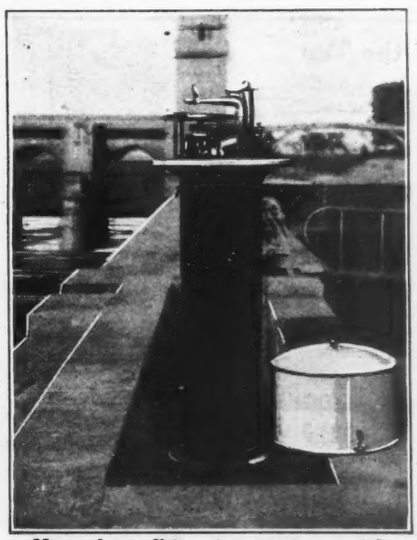
BY COMBINING the telephone and phonograph, an English firm has perfected a novel device that automatically announces in either words or code signals the height of water in a distant pond or reservoir.

The recorder can be "run up" or switched into any existing telephone or telegraph circuit when information about the height of water is sought. As installed, the new device consists of a phonograph mechanism with a phone transmitter substituted for the sound box. An electric motor drives the record table, and a relay, acting through levers, stops and starts the machine and lifts the needle from the record.

Float Controls Recording Needle

The recording disk contains 200 concentric grooves, each groove a vocal record of a certain height of the water. By the movement of a float that rests on the water, the tone arm, sound box, and recording needle are moved laterally into position with the disk in such a way as to give the correct reading when the needle is brought into contact with the disk.

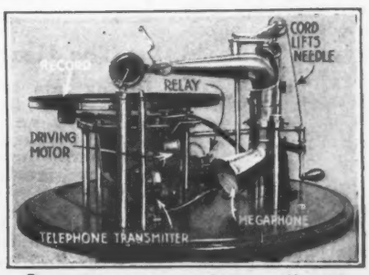
To effect this contact, the sound box, with needle, is automatically lowered when the disk mechanism is in rotation, and raised again above the disk when the mechanism stops.



How the talking instrument, with telephone transmitter substituted for sound box, is installed at the reservoir

The instrument is connected in the usual way with the nearest telephone exchange, and is given a regular subscriber's number. When the inquirer seeks information about the height of the water, he asks Central for this number. As soon as the instrument phone rings, the needle immediately drops to the record, which makes three revolutions, and a voice announces over the telephone line the exact height of the water. The short "speeches" on the record range from "empty" to "one, double nought," enunciating each digit of a figure, such as "seven two" and "seven two half." The mere ringing of the phone sets the mechanism in operation, delivers the spoken information, and closes the recorder.

In the code signal type of mechanism the grooves on the record contain various combinations of dots to represent the changing height of the water.



In response to a phone call, this mechanism automatically starts a phonograph record that telephones the water level

Office Safes Survive Terrific Roasting in Test Oven

Novel Theater Audience Sees Undamaged Papers Removed from Improved Steel Cabinets After Dramatic Ordeal of Fire

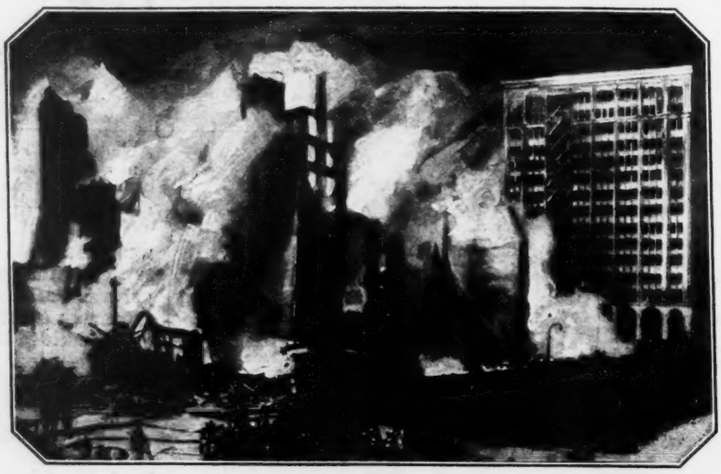
FIVE hundred salesmen, their eyes focused on one point, gaze with eager interest and suppressed excitement as a white hot steel safe, weighing half a ton, is drawn from a roaring inferno of fire and quickly swung three stories in the air. They hold their breaths during the short interval in which the craneman gathers his strength for a powerful jerk at the release rope. Dropping like a fiery meteor with a trail of scintillating sparks, the safe turns over slightly in its flight and crashes, corner first, on a pile of broken bricks. Two laborers rush in with a streaming hose and play it on the mass of hot steel, enveloping it in a haze of hissing vapor.

Heat and Fall Leave Safe Intact

Soon the clouds of steam thin and operators equipped with asbestos gloves approach the safe and open the door. The theoretical conflagration is over and the safe, after subjection to a heat seldom attained in ordinary fires, combined with a fall such as might conceivably take place when floors collapse during the height of a devastating fire, is seen to be still intact, with its contents of inflammable paper showing no signs of the fire it has been through.

Such is the spectacular demonstration staged periodically for visiting salesmen and executives by a progressive manufacturer of a fire resistive safe. So valuable have these tests become that a special laboratory has been built in Marietta, Ohio, where new models of safes are subjected to similar rigid experiments. Equipment has been added by purchase or by invention that will simulate every known condition that safes must withstand in actual conflagrations.

It was a Methodist minister who, some 15 years ago, conceived the idea that a safe might be constructed that would be not only lighter in weight and greater in capacity than the old style iron safes then commonly in use, but also absolutely proof against destruction by fire. This man realized, as many others never have, that the contents of a building are not included when the term "fireproof" is applied to a structure. For while fabricating materials such as concrete and steel, with which a building is erected, may be proof against fire, the furnishings and equipment of buildings are usually of the most inflammable nature.



Are Modern Office Buildings Really Fireproof?

PAPERS containing records valued at more than $5,000,000, locked in safes that were relied upon to be fire and burglar proof, were burned to cinders in a $15,000,000 fire, illustrated above, that recently swept the upper stories of the Burlington office building in Chicago, also believed to be fireproof. This disaster—called at the time America's first serious skyscraper fire—instantly raised a question among engineers as to the safety of huge modern office buildings hitherto supposed to be completely fireproof.

Subjected to the terrific heat from blazing buildings 80 feet away, the wooden window sashes of the Burlington Building were first ignited, and their destruction opened the window spaces to the full effect of the fire. Even window panes with wired glass melted and pulled away from the sashes.

Thus breaking into the building, the flames found ample food in the wooden desks, doors, and cabinets of the interior, while the wooden trim of the so-called fireproof partitions was the means by which they spread throughout the building.

The disaster indicates that no building is proof against the ravages of fire as long as its contents—furniture and trim—are inflammable. The fireproofing of vital records, therefore, becomes of importance, and the reason is seen for the seemingly elaborate tests administered by an American safe building company to its products. The spectacular tests are no more severe than conditions actually encountered in the Chicago catastrophe.

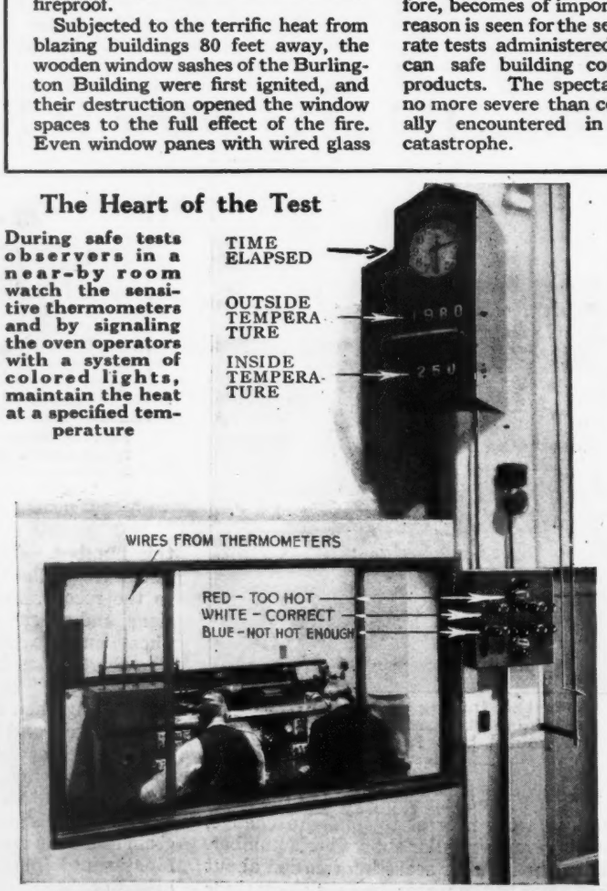
Parson's Idea Is Successful

After wide research and experimentation the Methodist minister completed a safe that under test proved to be all that he hoped. But though convinced himself, he found that salesmen and prospective purchasers still retained a measure of doubt that those light weight safes could do all that he claimed. So the testing laboratory and the spectacular tests were called into existence.

Previously safes had been tested by placing them in wooden huts and igniting the huts, but such tests were not exact imitations of conditions encountered in real fires. Test conditions could never be duplicated; results varied with the wind, and there was no way of surrounding the safe with burning gases.

The Heart of the Test

During safe tests observers in a near-by room watch the sensitive thermometers and by signaling the oven operators with a system of colored lights, maintain the heat at a specified temperature



Details of the Test

The most important apparatus at the present testing laboratory is a huge oven that can be heated to temperatures as high as 2000° F. by burners supplied with a special grade of high temperature gas delivered through a six-inch main. Air blowers supply the air for proper combustion of the gas.

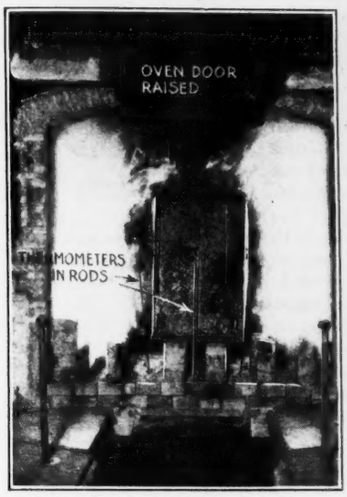
After the safe to be tested is stuffed with books and loose papers in simulation of the customary office safe, several sensitive thermometers, called "thermocouples," are placed at selected locations inside the safe and outside in the oven. The safe is then locked, the oven door closed, and the burners are lighted.

At the end of five minutes the thermocouples register a temperature of 1100 degrees; five minutes more and the heat

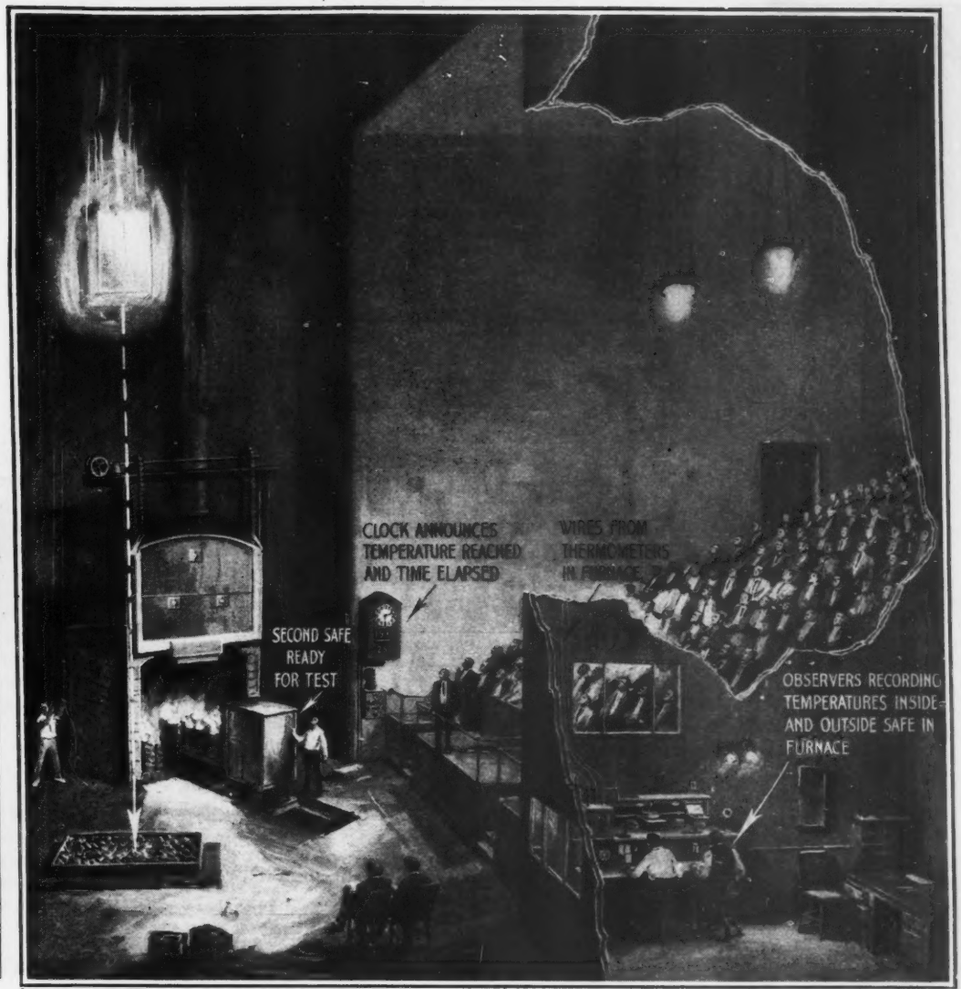
has increased to 1400 degrees; at the end of 30 minutes the heat within the oven stands at 1650 degrees; and finally, after two hours, a top temperature of 1950 degrees is recorded.

Through mica peepholes in the oven side, the safe appears as a mass of flaming red steel with burning gas enveloping it from top to bottom. In a near-by room observers watch the thermocouple readings and maintain the heat at the predetermined temperature by signaling the oven operators through a system of colored lights.

After the completion of the heat tests, the safe is withdrawn from the oven. A crane hooks it, then lifts it 40 feet in the air. It is released and dropped on a pile of broken bricks. Following this crashing fall, the safe is returned to the oven for a second period under high temperatures. This reheating is supposed to imitate the roasting undergone by the safe after it has fallen through a collapsed floor into a mass of burning debris. After an hour the safe is again withdrawn from the oven and cooled by streams of water.



Rods containing thermometers are placed around the safe to indicate the oven heat


CLOCK ANNOUNCES TEMPERATURE REACHED AND TIME ELAPSED
SECOND SAFE READY FOR TEST
OBSERVERS RECORDING TEMPERATURES INSIDE AND OUTSIDE SAFE IN FURNACE

Before a gathering of salesmen and buyers, the white hot safe, hoisted to the ceiling, plunges 40 feet with a spectacular crash onto a bed of broken brick

Not all the safes are tested in the presence of thrilled audiences. The staff at the laboratory is constantly at work on routine tests, the results of which will tend to improve the quality of the product. Every 60 days a number of safes of all sizes are taken at random from stock and subjected to the most strenuous tests.

The rating is based on an arbitrary standard selected after an experiment conducted by M. L. Carr, director of the laboratory. Under his supervision, sheaves of printed paper were placed in an oven and slowly roasted. As the temperature increased, the condition of the paper was noted through the glass front of the oven. At 500 degrees the paper had charred to a point where the writing and printing were illegible. Three hundred degrees was therefore selected as the limiting temperature that should be permitted in a safe.

Based on this standard, a safe that shows an inside temperature of 300 degrees after exposure for two hours to an oven temperature of 1950 degrees, is classed as a two-hour safe. A three-hour safe can stand off the 300 degrees inside heat for three hours.

Unusual Flying Boat Has Hull and Wings of Duralumin

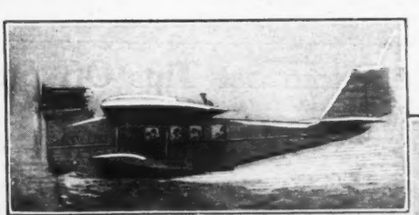
OUTSTANDING in its design because of its light weight, casehardened metal body and the elevated position of its engine, the flying boat designed by Herr Dornier, Zeppelin designer, represents the latest advance in combination water and air craft.

The specially prepared duralumin of which the hull of the boat is built, is processed to protect it against the corroding effects of salt water. The engine is located high in front of the pilot, out of the way of the salt water spray.

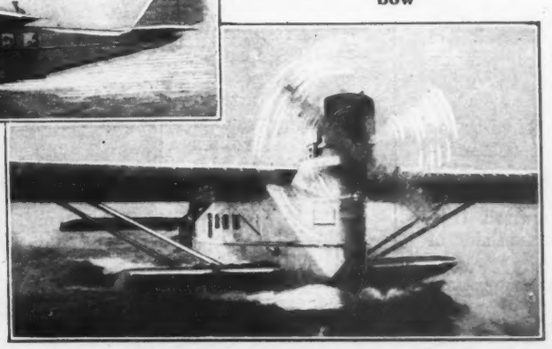
The top wing is unusually thick—in fact, it is a modification of the popular cantilever wing form. It will be noted, however, that this heavy wing is rigidly supported by stout diagonal struts from the lower wing surface. The lower wing acts like a huge fin, performing a double duty as a lifting surface, both in the water and in the air.

The cabin of the plane offers comfortable accommodations for eight passengers. The pilot's cockpit is in the nose of the machine.

The sturdy flying craft appears to be well adapted for cross country aerial transportation service, using lakes and rivers as landing fields.



The front view of the hydro-airplane, below, shows the lower fin in action, lifting the bow



Eight passengers, four on each side of the cabin, can be carried in the Dornier craft. Note the position of the engine high in front, out of the way of the spray

IF YOU want to attract the birds, plant the right trees and shrubs. Red cedar, the native flowering dogwood, and Virginia creeper are best.

Pipes Laid with Drills to Save Lawns

USING compressed-air driven drills and extension rods, a light and power company in Brooklyn, N. Y., has found it economical when installing electric light supply lines to bore holes from cellar to street rather than to dig trenches as is usually done. Distances up to 40 feet have been successfully covered by this method.

The cellar wall is first cut through with a chipping hammer. Then a drill, such as is used in coal mines, is inserted in the air hammer and the ground perforated for a distance of 10 feet, which is the limiting length of the drill. For longer distances extension rods are added to the drill. Compressed air is supplied by a gas-engine driven air compressor, mounted on a trailer and drawn by the truck accompanying the working crew.

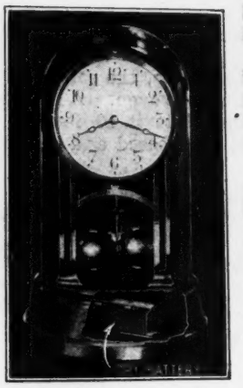
Inserted through a gap in the cellar wall, the compressed-air drill bores a tunnel for the pipes

Seventy-five per cent of the jobs can be handled in this way. The drills have been successful in pounding their way through all kinds of obstructions except round boulders. When these are encountered, a slight change in direction of the opening is usually effective in passing around the obstruction, enabling the drill to continue its work.

Dry Cell Swings Pendulum of "Never Wind" Clock

"PUT out the clock, wind the cat, and come to bed" as a night-time admonition may soon be scrapped by the perfection of a clock that keeps step with the minutes month after month practically without attention. George S. Tiffany, of Summit, N. J., the inventor, calls it a "never wind" clock.

The principal parts of the timepiece are a small dry battery located in its base—renewed once a year—an electromagnet, and a torsional pendulum. The dry cell takes the place of springs or weight.



A dry battery takes place of springs

To start the clock, an initial impulse is given the pendulum with the hand. The movement of the pendulum opens and closes the circuit of the electromagnet, supplying the pendulum with the impulses that swing it forward and backward. With each of these movements the wheel of the clock is moved a distance of one tooth. Since the pendulum does no direct mechanical work, the friction is reduced to a minimum.

Except occasional regulation, the clock requires only a yearly renewal of battery.

Six Shooter Is Combined with Flashlight

BY COMBINING a flashlight with a six shot revolver, S. P. Cottrell, of Buffalo, N. Y., has produced a weapon that is particularly valuable to night watchmen.

The barrel of the gun is fastened to the top of the flashlight tube, and the magazine holding the six cartridges is within the tube.

The gun is fired by a standard trigger protruding through the bottom side of the flashlight.

The light may be used either separately or in combination with the weapon in case of emergency.

Vines Planted with Aid of Electric Drills

BY THE use of an electric power drill, a Californian grape grower has devised an ingenious method of planting his 200 acres in record time.

From a near-by power line, an insulated cable long enough to reach every part of the planting area was extended by permission of the power company. Four ⅝-horsepower electric drills, each fitted with a three-inch auger, were then connected with the portable cable. One man was detailed to look after the cable and another to operate the drill. A third placed the grape cuttings in the holes and tamped the earth around the roots. It was an instant's work to drill a hole 14 inches deep, ready for the plant.

Not only was time saved in planting, but the cost was much reduced.

Attached to a portable wire from a power line, the drill bores holes for the grape plants

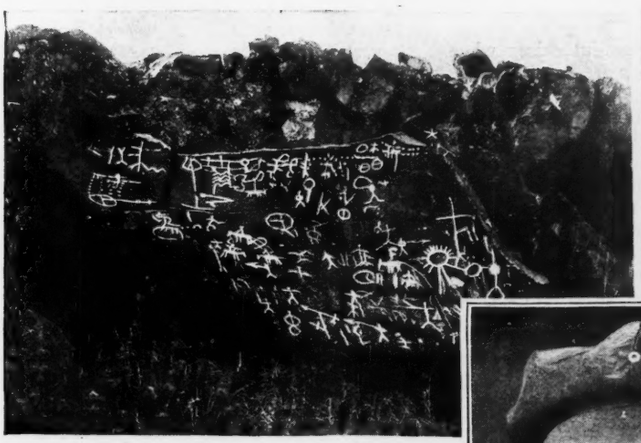
Pocket Radio Set Tips Off Stock Brokers

A MYSTERIOUS leakage of secret information from the stock exchange to curb brokers was recently traced by an officer of the San Francisco detective force to a member of the exchange who carried a miniature radio transmitter strapped around his waist.

The batteries were carried like gun cartridges in a belt around the man's waist. Also around his waist were many turns of insulated copper wire used for the aerial.

Signals were sent by a muted buzzer operated by a miniature telegraph key concealed in a side pocket. Code signals could always be caught by a supersensitive receiving set in the near-by broker's office.

Explorer Finds Strange Relics of Lost Race



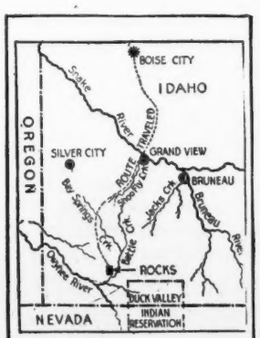
These strange symbols, made up of several layers, extend along the face of the cliff for nearly half a mile

Another rock covered with mysterious symbols. Note arrow leading over ridge of rock to unexplored cave near by

Robert Limbert, of Boise, who while exploring a wild section of Idaho, stumbled across the rock carvings that may be the key to the earliest American history

FLAT boulders of volcanic lava, mysterious caves and secret mounds, covered with pictorial inscriptions that may have been the work of America's earliest inhabitants have been discovered in a deserted section of Owyhee County, Idaho, by an exploring party led by Robert Limbert, of Boise.

Few of the symbols have been recognized by native Indians as those of their ancestors, the notorious Shawnee tribe that roamed the Idaho plains before the white man came from the East; but most of the writings from their appearance and description seem to ethnologists to be the work of natives hundreds and perhaps thousands of years ago. More than 30 acres of rocks in the sage covered plain near the junction of Battle Creek and Deep Creek in southwest Idaho are covered with hieroglyphics.



Route followed by the Limbert party and the spot near Battle Creek where the writings were discovered

Two distinct types of rock writings have been found. One is the ideograph or sign type, similar to those discovered on the ancient rocks of China; the other is the pictograph type, used extensively by the early Indian tribes of America.

Most of the writing has been done on flat or sloping rocks, but in one place Mr. Limbert discovered an interesting variation. A lava cliff that formed the south wall of a grassy plain was covered for nearly half a mile with thousands of mysterious inscriptions. In many places the ideographs had been overwritten with pictographs.

The mysterious mounds that were found near by may contain relics of inestimable value. These mounds, 20 in number and all pointing north and south, are from three to four feet wide and from two to three feet high.

In the same vicinity are strange caves that have never been explored. On them and around them are arrows pointing like an ancient "follow the arrow" game. Usually a series of arrows terminates at one of the mounds or cave openings.

Near one large rock covered with undeciphered inscriptions Mr. Limbert discovered a small pile of broken rocks with openings through which a draft of air blew continually, suggesting a second opening at some other spot. On a cold day in winter the moisture in this steady blast of air condenses in feathery puffs like a steam jet. In some of the smaller of these rock piles a quantity of decayed grass matting was found, with several flint knives and scrapers lying near by. At other places remains of tribal campfires were found.

Some of the collections of pictographic symbols have been shown to Mr. John E. Rees, whose associations with the Indian tribes of that section have continued for half a century. One of them, as translated by Mr. Rees, designated the grave of a favorite chieftain and described at length those feats of valor that had caused him to be highly revered by his followers.

Are these symbolic records the work of a race of people who preceded the cliff dwellers, Mayas, Aztecs, and Incas of Peru? This interesting problem cannot be solved until the mounds are explored and the strange markings deciphered.

Frail Canoe Supports Heavy Weight

The weight of seven men added to the ton load of heavy sand failed to buckle this canoe built of thin layers of veneer

TO DEMONSTRATE the strength of a new style canoe built of veneer, it was subjected recently to a weight of 3420 pounds. The sag was only three-quarters inch. By making the veneer in long sheets, the canoes are molded without joints below the waterline, except at the ends.

To This Child Musical Sounds Have Color!

Edgar Curtis, age 3½ years, picking out the "colors" he "sees" when different notes are struck on the piano

Edgar finds that C sharp on the guitar is "black," while on the piano it makes him feel "red." His color sensation thus changes with the timbre of the tone. Diagram at left shows how closely the centers of hearing and sight are associated in the brain

A SCOTCH woman with a broad "burr" in her speech was reading a story not long ago, to little Edgar Curtis, age three years and seven months, the son of Professor and Mrs. O. F. Curtis, of Cornell University. When the story was ended, the child said to his mother:

"Do you know what color it is when she reads? It's black."

A brilliant rainbow brought keen delight to the boy.

"A song, a song!" he exclaimed.

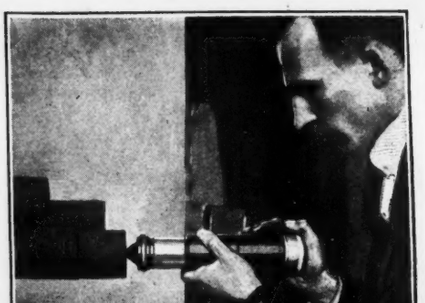
And so was revealed one of the most remarkable cases of "colored hearing" that has come to the attention of scientific investigators.

Persons who see beautiful colors when they hear musical sounds are not so rare as is commonly supposed, but most of them suppress their extraordinary faculty, thinking it sometimes freakish. But Professor and Mrs. Curtis, instead of repressing their child when he described certain musical tones as white, yellow, red or blue, allowed him full freedom of expression in describing these sense impressions.

Some of the boy's impressions have recently been recorded by Miss Anna Kellman Whitchurch, of Cornell University.

"Edgar often goes to the piano, and to amuse himself, touches the keys and tells the colors of the sounds," she writes. "Middle C he calls red, and the tones just below, red or red purple. The bass 'looks' black to him and the high tones white. Between middle C and the white tones he 'sees' reddish and bluish ones.

Edgar never of his own accord named tones yellow, green or gray; but during some later experiments when shown these colors he found tones for them all."



When disengaged, the hammer thrusts a hardened steel ball into the metal to be tested

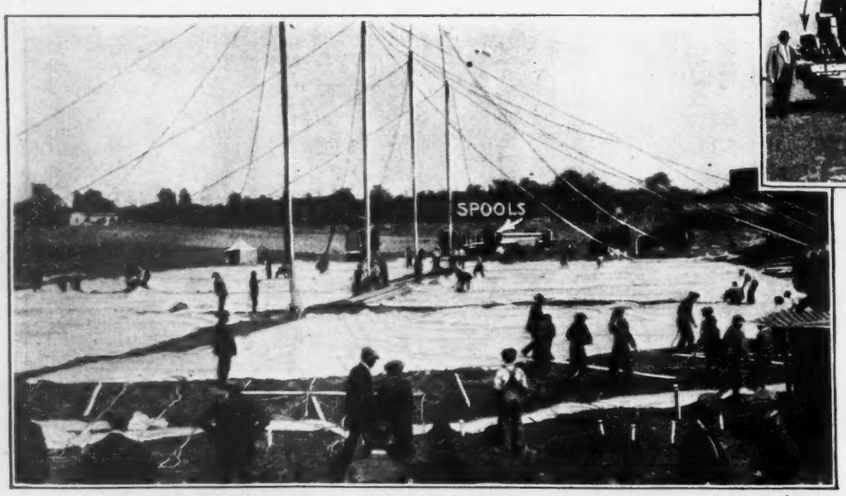
Small Spring Hammer Tests Hardness of Metal

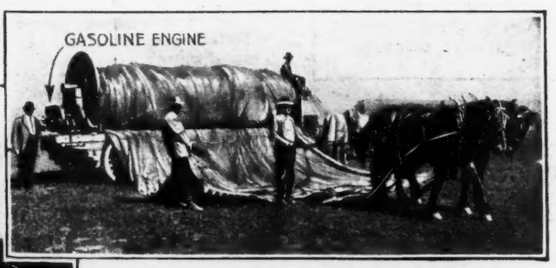
MACHINE shops that cannot afford the expense of a Brinell hardness testing machine may utilize an apparatus, said to be of equal accuracy, invented by Richard Baumann, of Stuttgart, Germany, which consists of two telescoping tubes. As the rear tube is pushed forward, a steel hammer in the interior is submitted to the thrust of a spring, and at the given tension, which can be adjusted by the operator, the hammer is disengaged. Flying forward, it strikes an anvil and thrusts a hardened steel ball into the material to be tested.

The remainder of the test is the same as the Brinell process. The diameter of the imprint is gaged by a microscope, and the hardness and strength of the material are derived by a formula. The new tool can be used both on small and large pieces, and as it has two thrusting intensities, it may be used either on soft metal or steel. The friction of the moving hammer is negligible, since it moves on a very thin spindle.

The tool is so light and small that it can be used as a traveling outfit, or even be employed to test each piece individually without removing it from the lathe.

Engine Winds Circus Tent on Spool





When the show is over, thousands of yards of canvas are wound on huge motor-driven spools. Inset shows a team of horses unwinding a big circus tent from one of the spools mounted on a large truck

HUGE, motor driven spools, on which circus tents are wound after the show is over, are among the most recent of the time saving devices by which circus managements have developed amazing speed in settling and "pulling up stakes" during one-day stands.

When the circus has completed its exhibition and before the last patron has left the grounds, the spool, mounted on a special wagon is backed up to the big tent, and one end of the canvas attached to the spool. The motor is started and the canvas slowly wound around the drum.

At the next stopping place a team hooked to the canvas quickly unwinds the tent.

Working Single Handed under Water, Diver Mends Ship's Bottom by Use of Pattern Patch

Remarkable Repair Job Completed in a Week without Drydock

SEVEN days after a submerged anchor had ripped a jagged hole in the bottom plates of the Japanese steamer Tamon Maru VIII as she was leaving the harbor of Newcastle, Australia, recently with a full cargo of phosphates, ingenious ship mechanics and intrepid divers, working continuously, had built a coffer dam around the break and applied a four-foot patch that failed to show a trace of leakage.

The feat was exceptionally remarkable for the fact that, since Newcastle has no drydock, it was necessary to survey the damage, make an exact pattern for the patch, and complete the repairs under water, while the big vessel floated beside her dock. The Tamon Maru VIII is 327 feet long, with a beam of 41 feet, and gross tonnage of 2977 tons.

All that had saved the vessel from sinking was her double bottom, as the collision ripped a jagged hole in the outer shell. Before the work of patching the hole could be undertaken by a diver on the outside and by men working between the false and the outer bottoms, it was necessary to clear the space of water and close the hole temporarily.

The damaged portion of the hull, about four feet six inches on a side, was first surrounded with a coffer dam, about six feet square, built of heavy timbers. By means of hook bolts, this dam was fastened to the hull by a diver. The space between false and outer bottoms was then pumped dry and an emergency entrance was cut from the tunnel through which the propeller shaft passes.

All was now ready for the actual work of preparing the patch. In cramped quarters between the floor of the hold and the outer plates, workmen removed the damaged portion of the plates, then drilled holes through the undamaged sections to receive studs for fastening the patch, and finally tapped and fitted seven-eighth-inch studs, about four inches apart.

When all the studs were in place, the manholes were closed and a diver, descending again below the ship's bottom, removed the coffer dam from the outside and prepared to measure the patch.

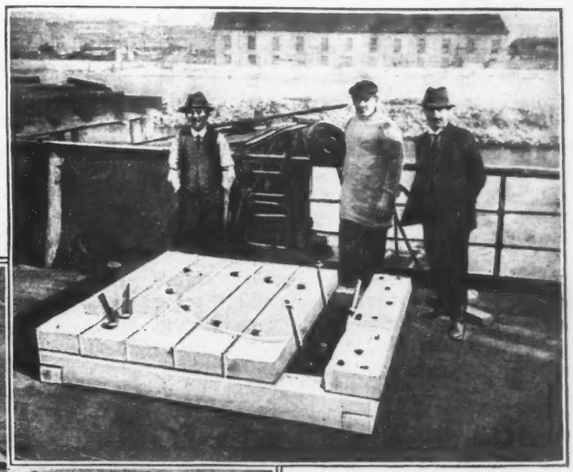
It was essential that the holes to be drilled around the edges of the patch should fit exactly over the studs protruding from the bottom of the hull. To this end, a template was prepared from rough measurements, with holes drilled sufficiently large to prevent any trouble for the diver in slipping the template over the studs.

Having placed the template in position over the hole, the diver, with the aid of a special, compass-like clearance nut, described a circle on the template around each stud, from which the exact center of each hole on the final patch was later determined.

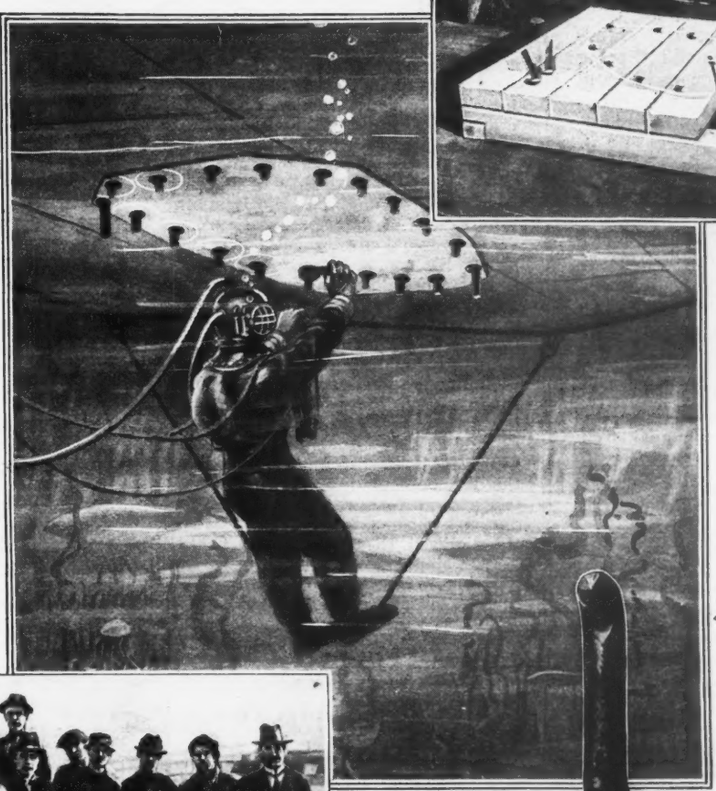
So successful was this method that although the holes in the patch plate were drilled to a tight fit, the patch slipped over the pilot studs and the 34 remaining studs without a hitch. The diver tightened all the studs to the limit.

Then, as water was pumped from the ballast tank, water pressure from below the hull forced the plate closer to the ship's bottom, while the diver took up slack.

To complete the work the plate on the inside was covered with a four-inch layer of cement, producing a patch so strong that the Tamon Maru VIII was given a bill of clearance from the port officials permitting it to proceed to any part of the world.

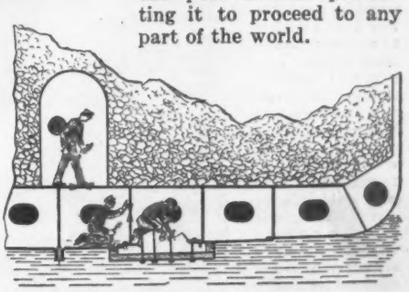


To permit repair work within the vessel's flooded ballast tank, a coffer dam of heavy timbers, shown above, was bolted by a diver to the bottom of the hull over the hole. The tank was then pumped dry



The patch plate, with holes drilled on centers determined by the diver's template, ready to be fastened on studs tapped through the ship's bottom

Using a special clearance nut (at right) as a compass, the diver described circles on the template around the studs, to determine the exact center of each hole to be drilled in the patch



Cross section of ship's stern, showing ballast tank where workmen made repairs, and protecting coffer dam

Radical New Shoe with "Automatic Fit" Promises Us Relief from Common Foot Troubles

Manufacturer's Scientific Shoes Based on Natural Foot Shape

By Robert E. Martin

THE neglected cause of a multitude of human ills—badly fitting shoes, which statistics show are worn by from 70 to 90 per cent of our male population, and which, science has lately proved, produce serious bodily disorders and actually gravely impair many a man's earning power—may be remedied by a radical change in shoe design now being developed in Rochester, N. Y.

After more than half a century in which machine-made shoes have been the standard American footwear, designed rather for appearance and economy than health and comfort, Oliver E. De Ridder, vice president of a great shoe manufacturing plant, has invented a new style of last that ingeniously adapts the inner sole of the shoe to the delicate contour and structure of the human foot. Mr. De Ridder made thousands of molds and measurements of feet during seven years of research work, before the new, specially shaped lasts were perfected.

What's Wrong with Modern Shoes?

That modern shoes, manufactured in quantity, and so designed as to crush the wearer's delicately curved sole against a flat surface, are really the fundamental cause of innumerable foot troubles, was the theory from which Mr. De Ridder started.

"All modern shoemaking machinery," he says, "is standardized and designed to the use of a last which is flat-soled. It does not attempt to fit lateral arches, and its heel tread is flat, or nearly flat. It is designed to produce inner soles that are practically flat. The channeling and welting machines are, every one of them, operated on flat-tread inner soles.

"The result of this method of compressing a beautifully curved foot against a flat surface is as senseless as the custom of binding a flat board to an Indian baby's head," says the inventor. "It has no justification from the standpoint of the anatomy of the human foot, which has three weight-bearing points, and four important lateral and longitudinal arches. Open and close your hand, and you will see the joints move from one position to another. There is a similar motion of the joints of the feet in walking. Indeed, the most beautiful mechanical devices and engineering structures are found in the foot, yet with the flat-bottom last now used we force these joints down upon a flat surface and depress the arches. The flat-bottom last is an anachronism, probably responsible for 90 per cent of the troubles which wearers of modern shoes experience."

The extent of these troubles is made apparent by the army's wartime experience. When the draft took able-bodied men of all classes to army training camps, an official inspection revealed that as many as 231 men of every thousand from the northwestern states and California were afflicted with

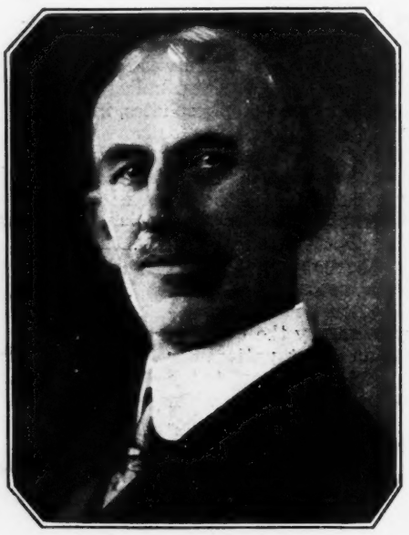
A Rebel Shoemaker's Message for You

"THE modern shoe carries its own condemnation with it—in the shape of no less than 126 devices now on the market for remedying the defects that it has caused in the human foot. Flat foot and the hundreds of other troubles that affect wearers of the ordinary shoe are caused by the struggle of the foot to accustom itself to a hard, flat sole that does not allow the joints of the foot free play."

This verdict of Oliver E. De Ridder, inventor of a revolutionary method of molding shoes to fit the natural curves of the human foot, comes with the authority of an expert who has examined and measured the feet of thousands of men and women, who has studied the history of shoemaking from its beginning, and who is known as "the Edison of the shoe industry."

"I have no doubt," says Mr. De Ridder, basing his conclusions on the results of these studies, "that if we were to cramp our hands in the same way that our feet have been cramped for generations, they, too, would develop bunions and broken down muscles."

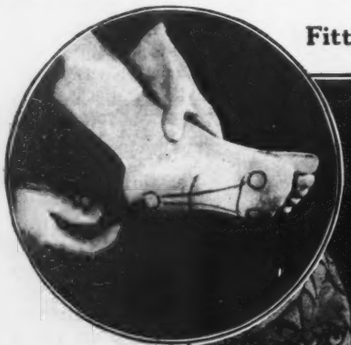
Thirty-five years ago, when De Ridder began as an apprentice in one of the largest shoe factories in Rochester, N. Y., he evidenced a bump of curiosity and a genius for hard work that soon resulted in the development of many important new features in footwear. From the start, although shoemaking machinery had been standardized to the use of a flat soled last, he challenged the correctness of this standard. His studies and his innovations eventually placed him in a position of authority, and today he is vice president and general manager of the factory in which he learned his trade.



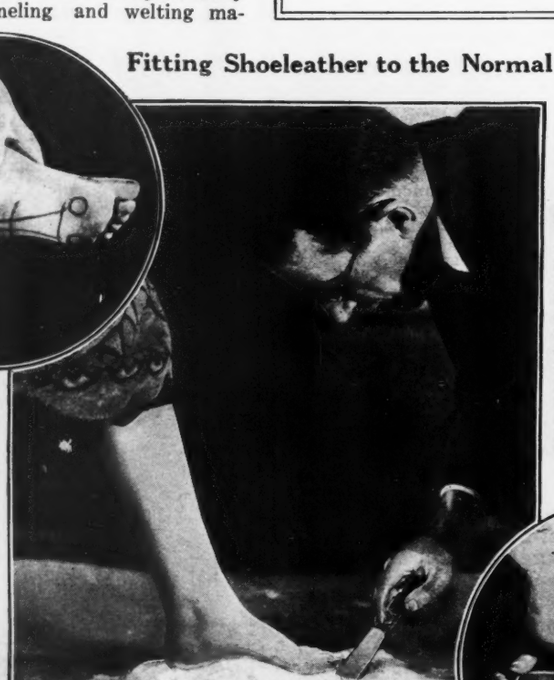
Oliver E. De Ridder

To avoid now some of the serious foot troubles that Mr. De Ridder hopes his new system of manufacture will ultimately correct, experts say that you should insist more strenuously than most people do on correctly fitting shoes; that you must avoid especially shoes that are too short; that you must not lace your shoes too tightly; and that you should give your feet variety, changing frequently from one pair of shoes to another, and to comfortable slippers at home.

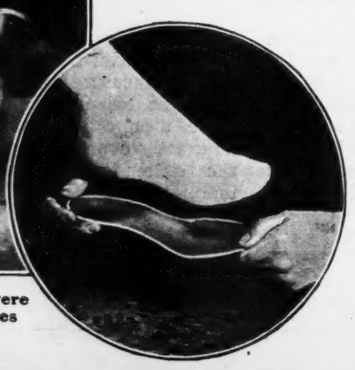
Fitting Shoeleather to the Normal Foot



Above: How contours of thousands of feet were measured in perfecting the revolutionary new shoe lasts. The small circles mark the three main weight-bearing points of the foot, while the lines trace four important lateral and longitudinal arches whose delicate structure is abused by badly fitting shoes



To establish correct contours, plaster casts were thus made of hundreds of normal human soles



Below: Three molded depressions in the inner sole of the De Ridder shoe receive naturally the three weight bearing points of the foot—the heel, "outer ball" and "inner ball"

Shoe Evolution—Queer Types of Other Days

None of the quaint shoes shown above, beginning with the light sandal of the ancient Greeks, was so injurious to the foot as some tight modern shoes, when incorrectly fitted. According to Mr. De Ridder, the evolution of the shoe has resulted, not in progress, but in a standardized product less hygienic than what our ancestors wore

What you see in one of the new X-ray machines, now increasingly familiar in many shoe shops. The normal position of bones and joints is shown in the upper X-ray inset, while the lower inset shows their compression by a new shoe that is both too short and too tight for its wearer

flat foot, while among men from the rest of the country outside of the South the ratio ranged from 80 to 144 in every thousand. On the other hand, among men from seven Southern states, the ratio was only from 41 to 79 a thousand. The astonishing comparative freedom from foot defects of Southern army recruits was attributed by medical experts to the more common practice in Southern rural regions of going barefoot during early years of life—apparently strong testimony to the evil effects of modern shoes.

The draft figures further revealed that from 70 to 94 per cent of all enlisted men wore shoes that were from one half to 3½ sizes too short! In fact, next to the stomach, physicians declare that the feet are the most abused part of the human anatomy, and the foregoing figures show that men are as guilty as women in this disregard of sensible hygiene.

Recent recognition of the serious consequences to general health from foot troubles has resulted in a national campaign for better-fitting shoes, launched in Chicago, Ill., by medical authorities, who assert that badly fitting shoes must ultimately succumb to the same fate as tight corsets.

Now the claim is advanced on behalf of the new shoe design invented by Mr. De Ridder that a bad fit will be impossible, since the inner sole in this shoe bears certain pronounced indentations that fit precisely the weight-bearing surfaces of the soles of the normal human foot, as determined after seven years of research in the making of an uncounted number of molds and measurements.

The mold in the tread of this new shoe may be compared with the impression left by your bare foot in the pliable, moist sand at the seashore. The inner sole is molded by steel dies, under high pressure, to these contours of the foot, and the shoe is built on a last thus molded.

The great advantage claimed for shoes built upon the new dies and lasts is that the depressions in the sole that receive the weight-bearing points of the foot, the inner and outer ball on either side of the metatarsal arch and the heel, hold the foot naturally and overcome the tendency to slip backward, forward, and sideways. This tendency is ordinarily resisted by binding the foot down against a flat inner sole, a barbaric process which weakens and strains the muscles of the arches, and causes a muscular fatigue which is communicated to the entire body.

In making these shoes the molded inner soles are assembled with the uppers on specially designed lasts, which also reflect the contours of the bottom of the feet, and a springy filler composition is placed between the molded inner sole and the *flat outer* sole. The entire sole is then rolled under pressure, so that the elastic filling fills the spaces between the inner and outer soles, the entire sole remaining comfortably light. The contours, therefore, remain fixed, while the outer surface of the sole is like that of an ordinary shoe.

Mr. De Ridder's effort, to sum it up, has been to design a shoe that will give the same foot comfort from the start that an old shoe does, without detracting from its outward appearance.

The Old Way and the New in Shoemaking

Above, at right: A typical flat-soled last. Contrast its shape with the natural foot, shown at right. Below, the De Ridder last, dotted lines indicating how its bulges correspond to the weight bearing points of the foot

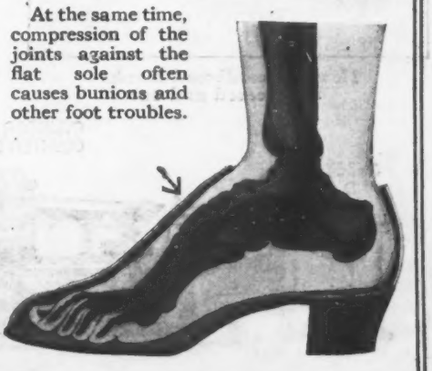
How Flat Soles and Tight Laces Ruin Our Feet

IN THE normal human foot the arch may be compared with a resilient bow, which bends under the weight of our bodies as we walk and gives the "spring" to our step.

The accompanying X-ray diagram illustrates the foot's bowlike structure and shows how, in a tightly laced, ill-fitting shoe, the joints of the foot are compressed, while pressure applied by the tight lacing in the direction of the arrow causes the arch to lose its natural, bowlike resiliency. The muscles that should pull it back into shape at each step are strained, and finally grow flabby.

Thus the arches break down, causing muscular fatigue that is communicated to the entire body.

At the same time, compression of the joints against the flat sole often causes bunions and other foot troubles.



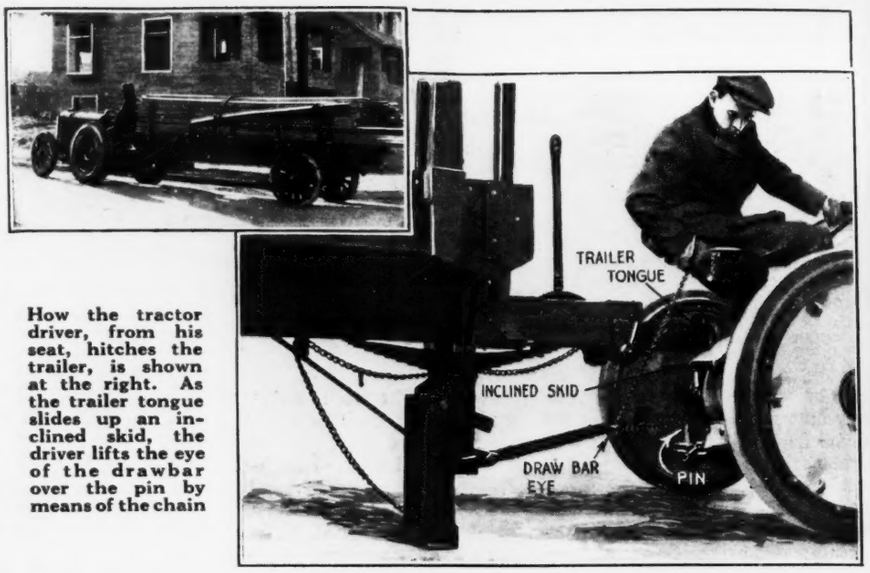
Automatic Hitch for Tractor Trailer

SPECIAL automatic hitching attachments for the tractor trailer, which transfer the dead weight of the trailer from the drawbar to the spring suspended platform of the tractor, have been incorporated in a new type of trailmobile.

By means of a long tongue that slides over the platform of the tractor, 30 per cent of the trailer load is pivoted directly over the tractor wheels where the traction is greatest.

Chain controls permit the tractor driver, from his position in the seat, to drop the trailer. First, the prop that supports the trailer when idle is lowered. Afterward a pin is pulled from the drawbar post and the eyelet of the bar lifted over the post. The tongue of the trailer slides down an inclined skid from the tractor platform.

In hitching the trailer, the driver uses the chain to guide the eye over the pin.

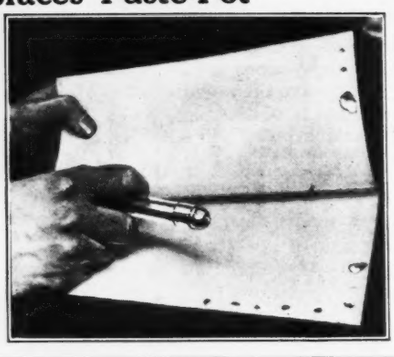


How the tractor driver, from his seat, hitches the trailer, is shown at the right. As the trailer tongue slides up an inclined skid, the driver lifts the eye of the drawbar over the pin by means of the chain

Glue Pencil Replaces Paste-Pot

A GLUE pencil that leaves a dot of mucilage wherever it is pressed upon the paper is the latest invention to replace the pastepot. The device is equipped with a small ball valve at the tip, similar to the valves in some types of grease cups. This makes the pencil leakproof, since the valve closes the tip until the pencil is held vertically and pressed upon the paper.

The barrel of the pencil is filled with mucilage by slipping off the valve head, just as a bottle stopper is removed.



Rubber and Auto Fuel from Corn Cobs

FROM the lowly corn cob it is now possible to produce low priced substitutes for hard rubber and synthetic resin products, thanks to research work by chemists of the Department of Agriculture. These chemists announce that a new motor fuel supply may also result.

These achievements, it is said, have been attained through the perfection of methods for producing from corn cobs a chemical compound known as furfural. The compound is made in a pressure cooker. Furfural, blowing off with the steam, passes through a condenser and is separated from the water by distillation.

New Machine Cuts and Folds 400,000 Boxes an Hour

WITH orders for folding boxes being placed by the 100,000,000, and with one plant alone producing 3,000,000 cigarette cartons every day, even the latest development in automatic machinery for making folding boxes, capable of turning out 400,000 units an hour, has difficulty in keeping pace with the public demand for package goods.

How the cardboard blanks are creased and cut

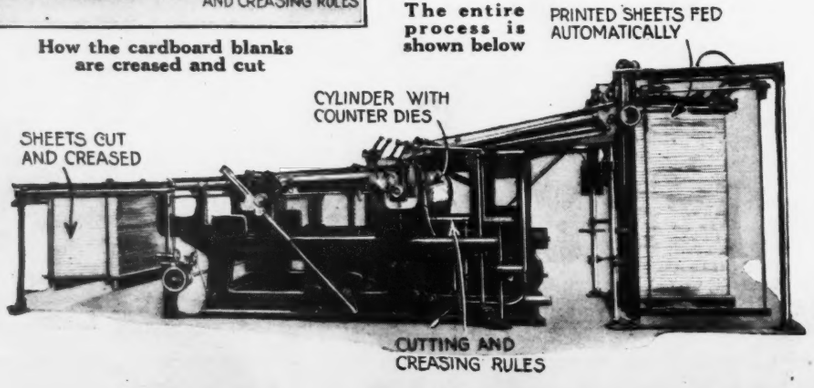
In the latest cutting and folding press the cardboard for boxes is first printed or lithographed on large sized sheets, often in six colors. As many as 300 complete patterns may be laid out on a single sheet of stock, and all of these are cut out simultaneously by a manifold cutting die.

To prepare the boxes for folding, another set of knives placed in the same die scores the creases. The difference in depth of cut between a cutting and a creasing die is only 0.005 of an inch. The diemaker cuts standard rules to the different lengths required for each die, and assembles them in a form as a printer assembles type, using blocks of cherry wood to fill in the blank spaces.

After the cutting form, or "chase" is bolted to the flat bed of the box making machine, a cylinder that rotates just above is prepared as a "counter die" by gluing a sheet of boxboard around the cylinder and cutting out a little strip of this paper over every creasing rule on the flat die. When the press is in operation, the creasing rules force the stock into these crevices, and make creases for folding, while the longer rules cut a little deeper and sever the stock into blanks for the boxes. The average speed of a press is 1500 full size sheets an hour.

The separate blanks are then fed automatically into a gluing machine, through which they pass at high speed. Here the inside edges of each blank are given a coat of hot glue, then steel rollers fold the blanks along the creased lines with sufficient pressure to glue the box tightly together. The finished boxes are then tied into piles of 100 on an automatic bundling machine.

The entire process is shown below



Snakes Kill Few Persons in the United States

DEATH from snake bites in the United States is comparatively rare, although the average mortality from venomous snakes is more than 10 per cent of the persons bitten, according to figures compiled by the Biological Survey of the Department of Agriculture.

The reason for this is that relatively few persons encounter or are bitten by the dangerous species. The most venomous of American snakes live in sparsely settled districts.

Whole Community Joins in Nebraska Coyote Hunt

Above: A typical community coyote hunt at Holstein, Neb., in which thousands of grownups and children, forming a 10-mile hollow square, close in and trap the prairie wolves. At right: Nine of the animals bagged in the most recent hunt

THREE thousand men, women and children, distributed over a Nebraska prairie in the form of a hollow square, 10 miles on a side. At a signal, each of the four sides advances, closing in toward the center, guided by captains—and the fun begins.

Rabbits, scared from their burrows, scurry helter-skelter, pursued by the patter of rifle bullets. Grouse, frightened from cornfields, fly up over the inclosing lines, some of them to be dropped by crack shots. Other small animals and birds scamper and flutter to shelter.

Thousands Participate in the Hunt

The great community coyote hunt of Holstein, Neb.—the big event of the year—is on. And it is a community affair indeed. Long before the day is set, "Are you going to the wolf hunt?" is the one important topic of conversation in Nebraska counties within traveling distance of Holstein; and when the big day comes, hundreds of farmers with their families arrive in wagons, on horseback and in automobiles.

Although coyotes, the thieving wolves of the prairies, are the main objects of the hunt, any wild creature that runs or flies is a legitimate target.

When one of the prairie wolves is sighted, the cry "Coyote! Coyote!" passes down the long lines. As the square grows smaller, fields, hills, and canyons are rapidly combed. The captains ride up and down the lines, closing unwatched gaps through which a coyote might escape.

Yet in spite of these precautions, during the last hunt three broke through the trap to freedom. One of them, creeping over a knoll, apparently hoping to escape the advancing line, which he could see from either side, crouched low in the grass until the tread of the feet was almost on him. Then watching his chance, he picked an opening and leaped for it. The surprised hunters missed shot after shot, and the frenzied animal, traveling at a pace that probably broke the record in coyote annals, actually distanced the gun shots and made himself safe.

A flag tower in the basin of a ring of hills was the objective of the closing lines. But instead of closing up at once and despatching the corraled wolves, the hunters halted a few hundred yards away while horsemen entered in a futile but exciting attempt to rope the coyotes. One rider, failing to loop the animal he was chasing, caught up with the elusive creature, and grasped it by the tail, later riding around the ring proudly displaying the snarling beast before killing it.

Finally the thousands of closely packed foot hunters impatiently broke from the lines, firing at the animals whenever the chance offered. When the closing signal was blown, a counting showed nine dead coyotes. The pelts were auctioned off and the proceeds donated to a local charity.

Fire Blasts Kill Weeds in City Parkway

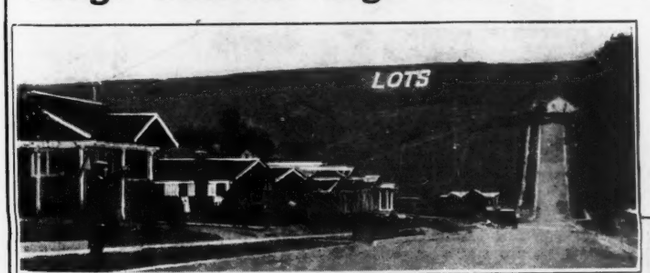
FIRE-BLASTING is now being used to destroy weeds along the parkways of Alhambra, Calif. The city has equipped a wagon with a combination pressure tank,

Blasts of flame from a mixture of kerosene and air, sear the weeds

a kerosene reservoir, and a small gasoline engine to drive a centrifugal blower.

From the tanks the mixture of vaporized kerosene and compressed air is delivered through hoses ending in long metal nozzles improvised from 1½-inch pipe. The blast of flame is so hot that weeds are consumed in an instant. Two men with this apparatus can destroy as many weeds in an hour as they could dig in a day.

Huge Hillside Sign Built of Old Boxes



CLOSE inspection reveals that the builder saved money by forming odds and ends of packing box lumber into letters and painting them

ON A steep hillside in the suburbs of a southern California city is a huge outdoor advertising signboard consisting of but one word—"Lots"—in white letters 75 feet high and a maximum width of 20 feet. The sign can be seen and read for two miles along a much traveled boulevard. From a distance it appears as if it were built of concrete, but—

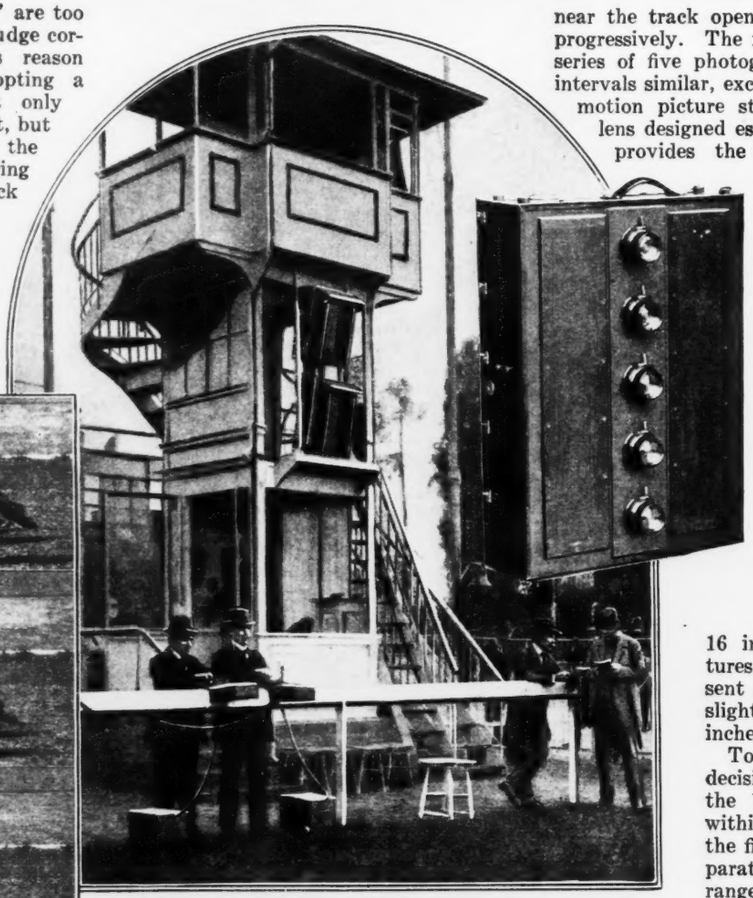
Camera Reveals Winning Horse when Judges Fail

HORSE races "won by a nose" are too close for the human eye to judge correctly, say experts. For this reason European race tracks are adopting a photographic method that not only pictures infallibly the final result, but also preserves a vivid record of the thrilling progress of the leaders during the last six feet of a neck-and-neck run.

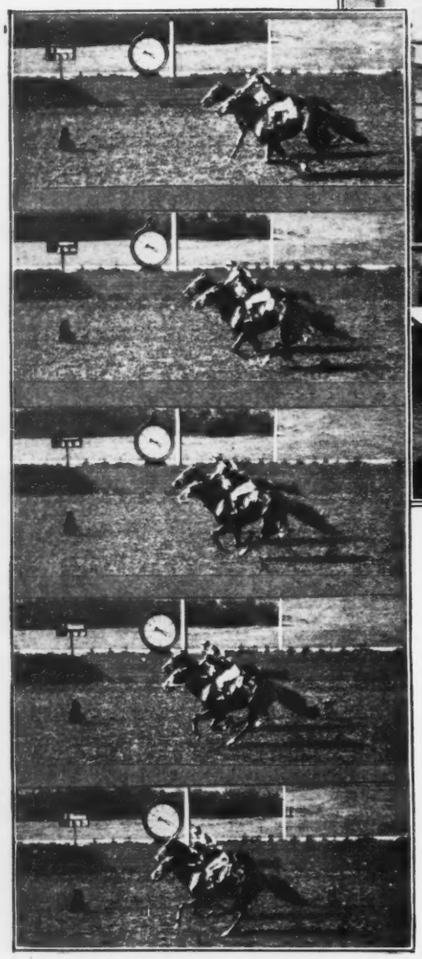
Five individual cameras are inclosed in one box, with the lenses arranged one above the other. Electrically controlled shutters set in motion by observers near the track open the camera shutters progressively. The result is a progressive series of five photographs taken at brief intervals similar, except in frequency, to a motion picture strip. An ultra rapid lens designed especially for the work, provides the necessary definition over a wide field. The plates are specially selected for their extreme sensitiveness. With the combination of fast lens and plate a shutter speed of 1/1300 of a second is possible.

An idea of the rapidity demanded in the lenses is easily understood from the fact that the distance covered by each galloping horse between one picture and the next is approximately 40 centimeters, or about 16 inches. The five pictures taken together represent a distance covered of slightly over six feet six inches.

To be of use as a basis of decisions it is essential that the plates be developed within a short time after the finish of the race. Apparatus conveniently arranged accomplishes this. In practice it was found possible to have the five plates developed and enlarged to a 16 by 20 sheet within eight minutes after the horses had crossed the finishing line.



Which Is the Winner?



Typical installation of the new European "umpire cameras," which reveal the winning horse in a close race more accurately than could any human eye, is shown above, the black boxes halfway up the judges' stand each containing a five-lens camera of the type illustrated in the inset. Note in picture at left, that the second horse passed the winner an instant after crossing the line

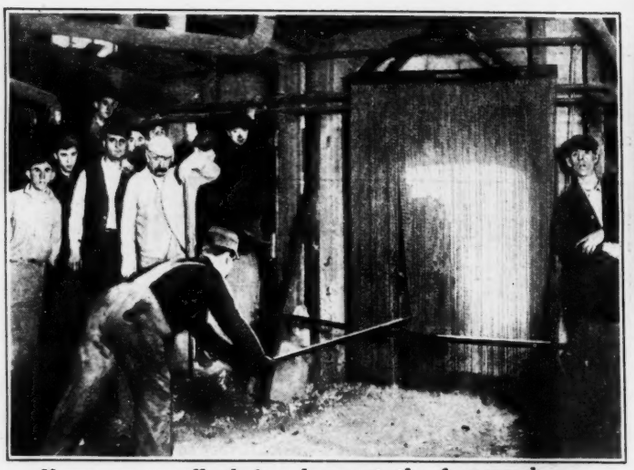
New X-Rays Discovered

MEASUREMENTS made in 12 different gases and vapors by the Bureau of Standards reveal X-rays having wave lengths never before known. There has always existed a dark region between the waves of visible light and those of the longest X-rays, but this gap is now nearly closed.

X-rays, light waves, and radio waves differ in their wave lengths. Radio waves are the longest, then follow light waves, which vary from the red end of the spectrum to the violet, and lastly the X-rays, the longest waves of which have been found to be only one billionth of a millimeter in length, a millimeter being about one twenty-fifth of an inch.

Chain Screens Protect from Furnace Heat

PATENTED protective screens, made of many small chains hung vertically from the top of the furnace door hold back the intense heat of the fire in many American factories and prevent flames from striking back at the worker when the door is opened. The fire is constantly visible through the strands, yet thermometers have shown that with the screen in place 85 per cent of the glare and heat from the glowing bed of coals is held by such means within the furnace.



Numerous small chains, hung at the furnace door, hold back 85 per cent of the glare and heat

Where tongs must be used to insert and withdraw material from the furnace, the chains terminate in metal tubing, since chain links would catch in the jaws of the tongs. In other installations the chains are arranged on pulleys so that when the furnace door is opened, the screen drops in front of the aperture.

During the recent test of the effectiveness of the chain screen, a thermometer registered a temperature of 110 degrees at a point 10 inches from the closed door. When the door was opened without a screen in place, the temperature increased to 400° F. Upon screening the door, the thermometer dropped to 135 degrees, showing a heat protection of 265 degrees.

Will New "Sugar Cane Lumber" Cut Cost of Home Building?

Great Strength in Boards of Waste Fiber

A NEW "woodless" lumber, manufactured from sugar-cane waste and remarkable for extreme lightness, strength, and excellent insulating qualities, is now being turned out by Louisiana manufacturers, who claim that their product will lower the cost of house construction, cut home fuel bills in half, and, when made into shipping containers, save hundreds of thousands of dollars annually in freight bills.

"Cane Boards" 900 Feet Long

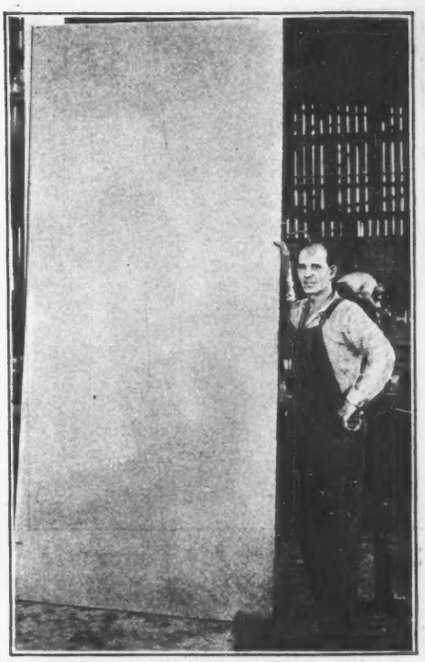
One of the unique characteristics of this "magic cane lumber" is the extraordinary size in which it can be manufactured, boards 12 feet wide and 900 feet long—nearly the height of the Eiffel Tower—having actually been produced in a plant recently erected in New Orleans, La.

The new lumber is made from "bagasse," which is the fiber left after the juice is pressed from the sugar cane. A yearly production of nearly 500,000 tons of bagasse was formerly burned under the boilers of the sugar refineries as the cheapest way of disposing of it; but recently a process has been discovered by which it can be converted into a lumber that will not split, and which is so light that a man can lift a board four feet wide and 12 feet high with one hand.

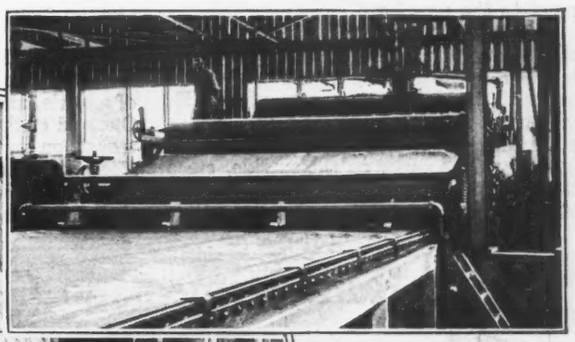
The first step in the lumber-making process is to cook the fibers in huge vats to kill the spores that otherwise would cause decay. The fibers are then placed in beating machines, which separate them. Here they are treated with waterproofing chemicals and coated with a sticky substance that makes it possible to mat them together.

The final step in the manufacture is to compress the fibers into lumber by passing them beneath heavy steel rolls. The lumber leaves these presses in long, continuous sheets that move slowly through a 900-foot drying oven, heated to 300° F., where the water content is evaporated. This oven is said to be the largest of its kind in the world, removing 120,000 pounds of water daily. The sheets are then cut automatically by saws into standard lengths, and stacked for shipment.

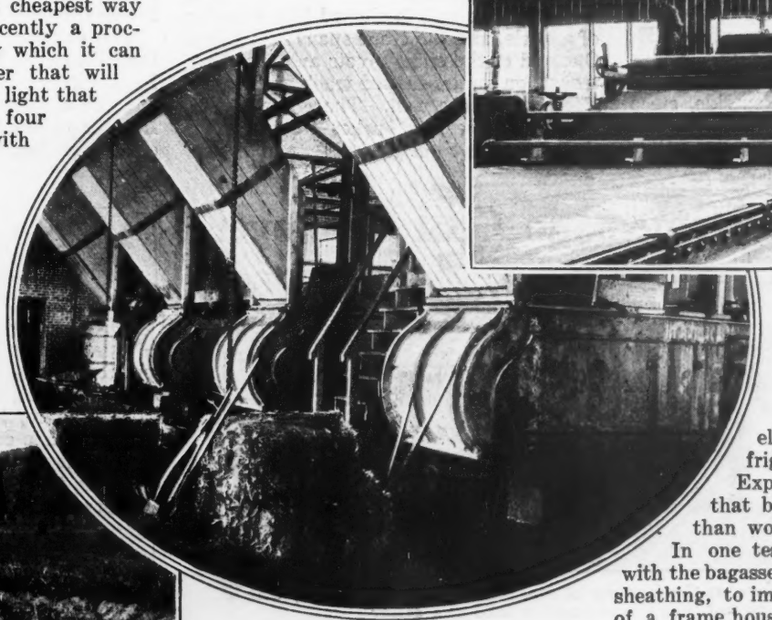
Like wood, the bagasse lumber is composed chiefly of cellulose. The finished product resembles exceedingly hard, tough cardboard.



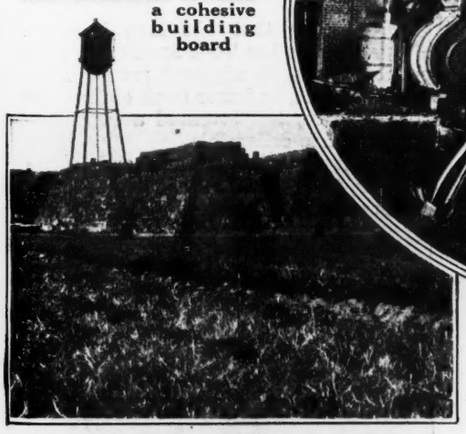
A 4 by 12 foot sugar-cane board that a man can lift with one hand



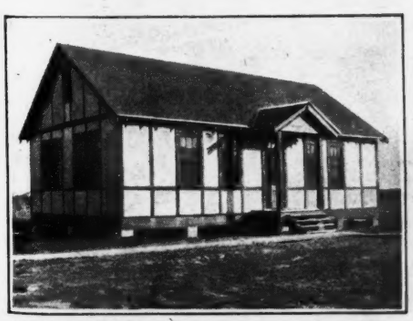
From beneath giant rollers that compress the sugar-cane fibers, the new lumber issues in an endless board



At right: In huge breaking machines the sugar-cane fiber is reduced to short lengths and mixed with chemicals to form a cohesive building board



Ten thousand tons of bagasse at New Orleans, waiting to be manufactured into building board



This bungalow was built entirely of the new woodless lumber

Because the fibers are very long, the material cannot easily be split by driven nails. The felting and compacting process fills the structure with tiny air cells that make it light and impervious to heat.

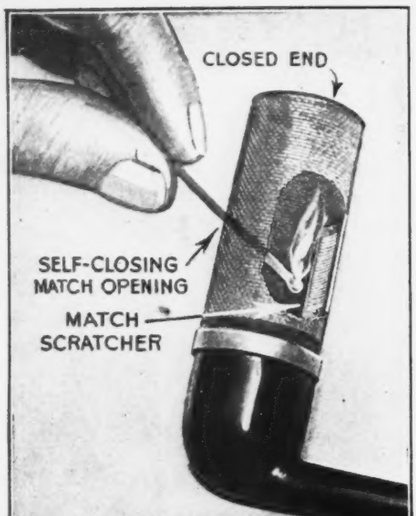
The new lumber is being used for siding on houses and for making packing boxes. Since quarter-inch bagasse boxing material weighs only a quarter of a pound to the square foot, its use results in a great saving in freight charges. For example, one company that formerly shipped 100-pound packages of merchandise in wooden containers weighing 20 pounds, now ships the same merchandise in bagasse weighing only 8½ pounds. For a distant shipment in carload lots, this company announces a saving of $1400 a car.

Because of its insulating quality, the new lumber in the form of boxes is said to hold merchandise at the packing-room temperature for three days when shipped in the ordinary freight cars. This quality often eliminates the need of refrigerator cars.

Experiments seem to indicate that bagasse lumber is stronger than wood for house construction. In one test, studding was covered with the bagasse lumber and ordinary wood sheathing, to imitate a section of the side of a frame house. The siding was nailed on in the usual way, and the lower sill of the frame was clamped to the base of a testing machine, while an upward pull was applied to the top plate. In the bagasse lumber, there was a movement of only 0.01 inch at a pull of 1200 pounds, and 0.42 inch at 2600 pounds, while the wood sheathing of three-quarter-inch boards six inches wide was moved 2.14 inches at 1200 pounds.

As a Substitute for Wood

Bagasse lumber is said to be fire resistant and to take paint, plaster, calcimine or stucco without treatment. One ton of bagasse will make 3000 board feet of lumber. The makers estimate that the waste from the Louisiana canefields alone could produce a billion and a half board feet of "lumber" annually. The best grades of this "woodless" ceiling and weatherboarding lumber recently sold at $38 a thousand square feet, as compared with a price of from $50 to $60 on ordinary ceiling.



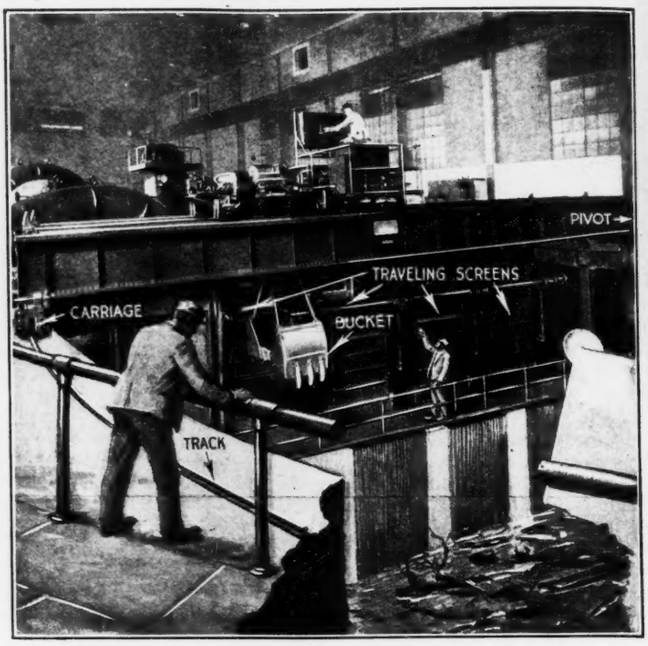
Smoking on Air Liners Is Safe with Pipe Cap

PIPE smoking on air liners is made safe by a novel pipe cap and lighter recently introduced in England. It consists of a cylinder of metal gauze closed at one end and terminating at the other in an attachment to the pipe bowl.

The match is inserted through a self closing aperture in the gauze and ignited by striking the head on a strip of abrasive material inside. The gauze allows air currents to pass inward and the smoke outward, but the flame within can never ignite gasoline vapor on the outside, since the fine wires quickly lower the temperature of the flame below the gas ignition point.

Traveling Crane Cleans Water Intake

THE use of a traveling electric crane to clear silt and debris from the water intake of a power plant is a new departure in engineering. In the installation at Cincinnati, Ohio, large debris is arrested by heavy iron grillwork backed by traveling screens, while a grab bucket from the crane removes both the silt from the well and the driftwood from the front of the hurdle or grill. The grab bucket is often called on to handle heavy material. Frequently it brings up large waterlogged timbers, and on one occasion a cow drowned in an upriver flood some weeks before.

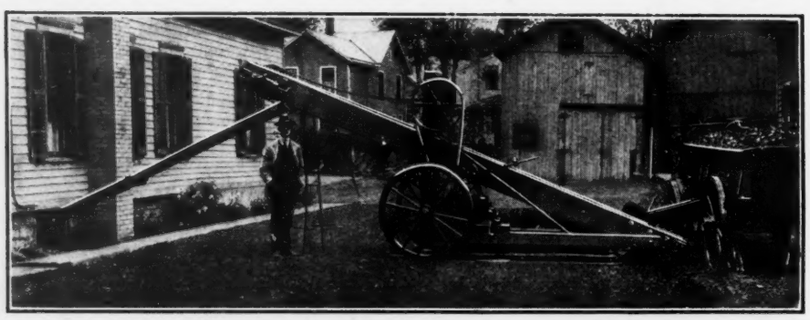


As the pivoted crane sweeps along the arc-shaped well, a grab bucket removes debris arrested by grillwork

The intake well is shaped like a sector of a circle, and the crane spans it radially. One end of the crane pivots and the other travels on an arc-shaped track at the outside edge of the well. The crane trolley with its suspended bucket travels along the entire length of the crane, and is controlled by an operator, who is guided in his action by peering down between the I-beams from which the bucket is suspended.

The extreme span is 50 feet, and the total lift of the bucket 100 feet. Two 7½-horsepower motors operate the trolley, and two 45-horsepower motors the bucket. All four of the motors are equipped with electric brakes.

Engine Runs Homemade Coal Conveyor



Coal passes through a chute at the bottom of the truck to the conveyor, which carries it to another chute leading into the cellar

TO DELIVER coal to customers living in houses 50 or more feet from the nearest driveway, without injuring the lawns, shrubs, and flower beds surrounding the dwelling, an ingenious coal dealer in Seneca Falls, N. Y., has built for himself a portable conveyor out of odds and ends picked up about his coal yard.

The conveyor, driven by a 1½-horsepower gasoline engine, is mounted on two wheels and is long enough to bridge a lawn from 30 to 50 feet wide. The coal is delivered to the conveyor by a short gravity chute from the bottom of the coal truck and is carried to the top of the conveyor trestle, where it is dumped into the chute that delivers the coal through a window to the bin in the cellar.

After the gasoline engine of the conveyor has been started and the trapdoor of the truck opened, the coal automatically begins its journey to the coalbin without any manual assistance. Two tons of coal can be delivered by this conveyor in not more than six minutes.

Sunlight Cure for Rickets

THAT rickets, a common disease among children, is caused by lack of sunlight rather than by lack of vitamines, as has been supposed, is the conclusion reached after experiments with sunlight at the College of Physicians and Surgeons, Columbia University.

Tests with animals revealed that the disease was contracted almost without exception by those kept in darkness, while other animals on the same diet, but exposed regularly to sunlight, showed no signs of the disease.

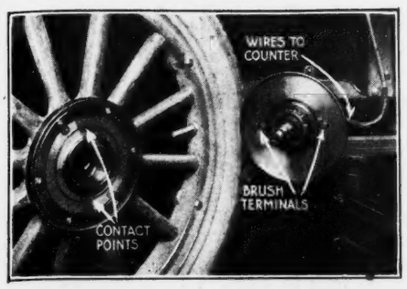
Ultra violet rays of the sun, passing through the skin, are believed to act powerfully on the blood, effecting what is usually a permanent cure.

Silent Practice 'Cello Is Collapsible

REALIZING that the long hours of practice on her 'cello sometimes bothered occupants of adjacent rooms, Mlle. Adele Clément, an honor pupil of the Paris Conservatoire, has invented a semi-mute 'cello which is collapsible.

Without sounding board and sound chamber, the 'cello cannot be heard outside the room in which it is played.

Practising on the silent 'cello



Counter on Auto Wheel Measures Distances

GREATER speed in road measurements, such as are required in staking out telephone poles, has been obtained by the invention of an electric device, attached to the automobile wheel, that accurately records distances.

The counter is mounted on the instrument board, and is operated by an electric interrupter on the front wheel, which consists of two small stationary brushes in contact with a revolving surface fixed to the wheel. Insulated segments set in the part attached to the wheel interrupt the circuit through a counter magnet as they pass over the brushes. The interrupter is arranged to count half revolutions of the wheel, each count representing about four feet.

The above photograph shows the wheel lifted from the axle, revealing contact points.

Movable Stairway Vanishes into Ceiling

PORTABLE stairways that slide into the room above have been developed for use in bungalows where space must be conserved and in houses where space is not available for permanent steps. A panel-covered opening about the size of an ordinary door accommodates the passage of the stairway through the ceiling.

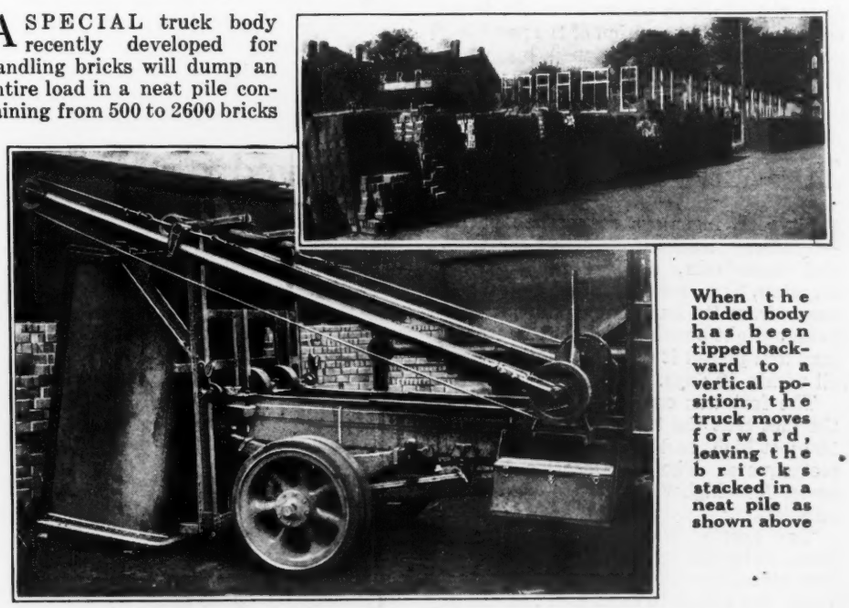
The stairway slides on rollers supported by the hinged ceiling door. When it is desired to use the steps, a slight pull on a chain lowers the panel and the stairs slide downward. A catch at the top holds them securely.

To raise the stairs the housewife slides them up on the panel, aided by the springs, partly supporting the weight of the stairs. After a certain point has been reached, the counterbalance formed by the upper end automatically closes the panel door into the ceiling.

Pull a chain, and the stairway slides down on rollers

Truck Body Dumps Bricks in Neat Pile

A SPECIAL truck body recently developed for handling bricks will dump an entire load in a neat pile containing from 500 to 2600 bricks without breakage. Only one man is needed to operate the truck and body.



When the loaded body has been tipped backward to a vertical position, the truck moves forward, leaving the bricks stacked in a neat pile as shown above

In loading the special body, a wooden platform or pallet is inserted in brackets at the rear of the body. The bricks are then piled against the pallet. When it is desired to dump the load, the power of the engine is geared through to a mechanism that tips the body backward to a vertical position. This motion deposits the bricks on the pallet so that when the truck is driven forward the rear of the body slides from under the pallet, leaving the bricks piled on it.

The body is demountable and may be set on or off the truck by using the power of the engine. One body can be left at the yard for loading while another is on the truck making a delivery.

The frame of the dumping device is bolted to the chassis of the truck and the hoist is set on a 12-inch channel. The cradle is pivoted on a rear dumping shaft in such a manner that when pulled back on the truck, the front end can be hoisted. The body slides along the truck on two large rollers, while two small rollers on the rear dumping shaft support the cradle.

Holding Cradle in Place

Projecting arms with hooks on the cradle engage a cross pipe on top of the body to hold it in place when the body is picked up or pulled from a pile of brick.

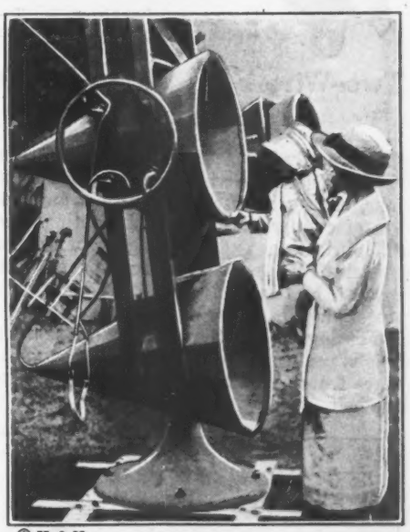
The hoist requires from three to five horsepower and is connected with the power take-off of the truck by a sprocket and chain.

Air Raid "Listeners" as Radio Amplifiers

LARGE horns that were used in England during the war to listen for the approach of German air raiders are being converted into radio horns for the entertainment of the public.

Instead of receiving sounds from the air and intensifying them by reflecting them upon a microphone placed at the tip of the cone, as they did during the war, these horns now act as megaphones for the broadcast distribution of sound waves reproduced in amplified intensity by the diaphragm at the small end, operated by the impulses of the radio waves.

The set shown below was recently used at a military exhibition at Tolworth, England, to amplify radiotelephone messages sent from airplanes.

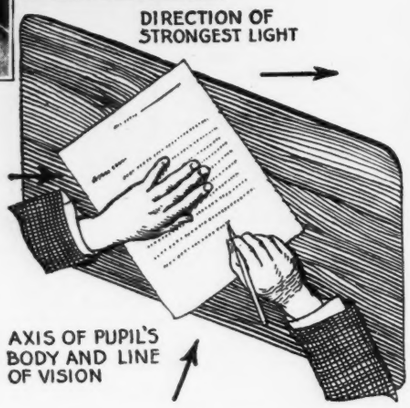


© K. & H.

Once used to detect air raiders, these horns are now radio amplifiers

Desks "Out-of-Square" Help Pupils' Eyes

With desks at an angle to aisles, the light passes over the "rhomboid desk," as shown below



TO SOLVE the problem of comfortably seating school pupils with their backs to the windows and their faces toward the teacher, and so eliminate eye strain, strangely shaped desks are now being manufactured, the tops of which are in the form of "rhomboids," or figures that may be described as "distorted rectangles," having opposite sides and angles equal, but not being equilateral. These desks are now in use in classrooms in Modesto, Calif.

In the usual modern schoolroom, windows occupy nearly 70 per cent of the wall area, and with the rectangular arrangement of seats, nearly three quarters of the pupils' work is done in direct and reflected sunlight, crossing the line of vision at an acute angle.

To lessen this angle the inventor has placed each desk and seat at an angle of 22½ degrees to the aisle. In order to keep the side edges of each desk parallel to the aisles, the top of the desk is shaped in the form of a rhomboid. The light from the windows passes over the left shoulder, and the position of the pupil is such that his line of vision is brought close to the line of light.

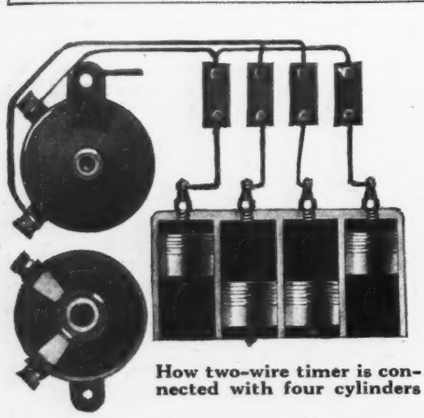
Twin-Seat Motorcycle Runs on Two Wheels

A MOTORCYCLE for two, with seats side by side and minus the sidecar requiring support by a third wheel, has been developed by a French inventor.

The frame of the machine supports between the wheels a cross frame providing a seat on each side and a double footrest large enough to hold small baggage. A double fork in front is turned by handlebars on each side of the machine.

The inventor claims that even a considerable difference in the weights of the two riders will not materially affect the balance of the machine and its vertical position.

How two ride side by side on two wheels



How two-wire timer is connected with four cylinders

Two-Wire Ford Timer Needs No Lubrication

IN A newly invented timer for Ford cars, which uses two wires instead of the usual four, sliding brushes and contact surfaces are of copper and brass, eliminating need of lubrication and insuring an excellent electrical contact of low resistance. The case of the timer is molded of composition material.

Fouling of the timer wires by the fan belt is prevented by locating the two lead wires from the timer on the side opposite the belt.

THE Editor will be glad to supply, wherever possible, the names and addresses of manufacturers of devices mentioned in this magazine.

200-Foot Radio Tower Moved on Railway

BY THE ingenious use of two parallel railway tracks, four street-car trucks and screwjacks, soldiers at Fort Sam Houston, Tex., recently lifted a steel radio tower from its foundation, transported it in an upright position to a site 250 feet distant and placed it on a new foundation—all within 10 days.

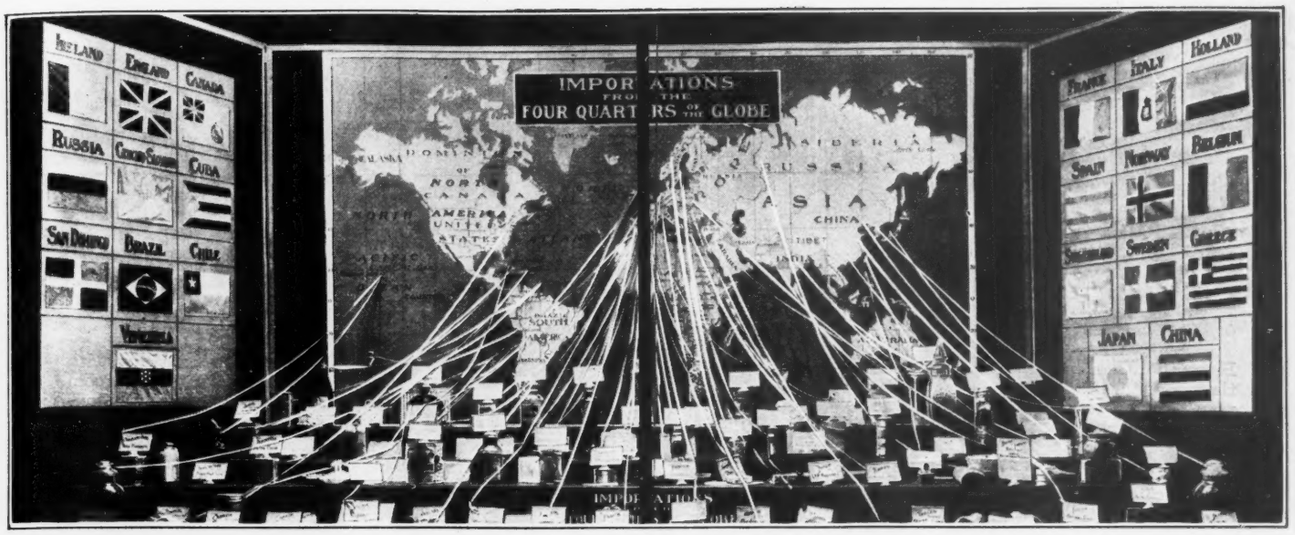
The feat was especially remarkable for the fact that the tower weighs 35 tons, is 200 feet high, and rests on a base only 26 feet square. The new location is nearly seven feet higher than was the original foundation.

Two parallel tracks were laid from the tower to its new location and on each track two street-car trucks were placed. The tower was guyed to dead men and the guy ropes were slowly paid out as the tower was lifted from its foundation by four screwjacks.

On each one of the four trucks, coupled in pairs, one of the supporting legs of the tower was placed. Then the trucks with their load were pulled by chain tackle up the slight incline to the new location. Lifting the tower off the trucks and depositing it safely upon the new foundation was accomplished by screwjacks.

Screwjacks raised the four legs of the radio tower to four trucks, which were hauled by chain tackle

Trade-Pulling Window Displays World Products



A WINDOW trimming idea that not only attracted a continual gathering of pedestrians in Boston, Mass., but brought many requests from school teachers for photographs of the display, consisted merely of a huge map of the world with ribbons connecting the various countries with samples of the food products obtained from each country.

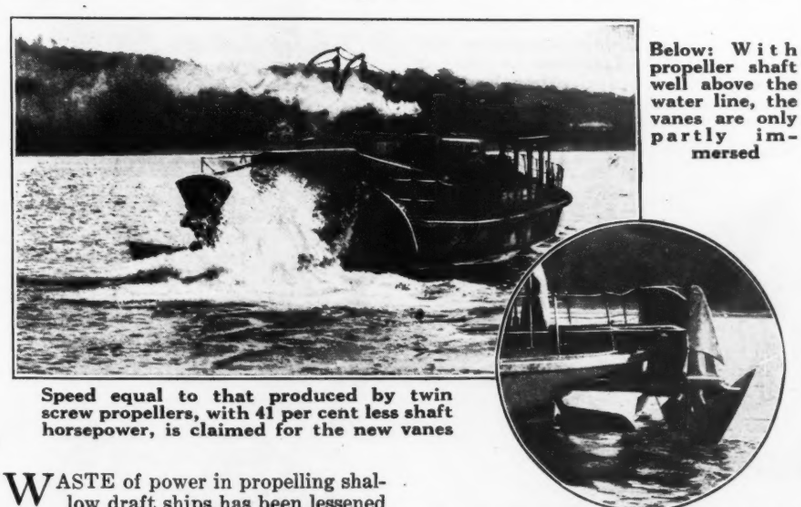
The map, like a back drop of a theater, filled the entire rear wall of the show window. Two panels at the sides carried the flags of all the nations. Ribbons attached to the map with thumbtacks led down to the items imported by the grocery firm in whose windows the exhibit was placed.

The map showed coffee from Brazil and Arabia, tea from China and Japan, India, and Ceylon, and oatmeal from Ireland and Scotland. Several ribbons led from Canada to packages of tobacco and containers of cheese. Spain contributed almonds, olive oil, and sweet red peppers; and San Domingo sent lime juice and pickled limes. Practically every item known to a household was present in the display and properly tagged to its source.

To add to the interest, a pile of letters carrying strange appearing stamps from all nations were scattered in the foreground of the window.

This unique educational window display is not limited to the grocer, but could be made fully as interesting by the druggist, candy store or dry goods merchant.

Shaft of New Propeller Is above Water



Below: With propeller shaft well above the water line, the vanes are only partly immersed

Speed equal to that produced by twin screw propellers, with 41 per cent less shaft horsepower, is claimed for the new vanes

WASTE of power in propelling shallow draft ships has been lessened recently by a Scottish firm of shipbuilders through the perfection of a method of driving such craft through shallow waters by means of "vane wheels," that are only partly submerged.

The vane wheel consists of a hub, to which are attached three radial vanes, similar in form to the blades of a ventilator. The vanes have a decided pitch and, striking the water at an angle when in motion, exert a forward thrust on the ship when rotating in one direction and a backward pull when rotating in the other. Each vane is riveted to two arms that form an integral part of the hub.

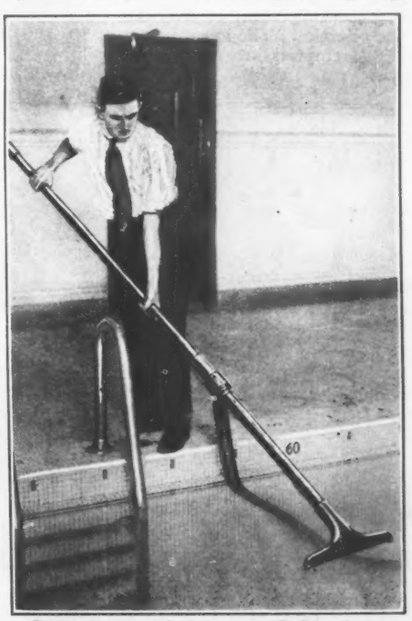
Two of these wheels are placed either side by side at the stern of the ship, or separately, at a slight angle, one at each side of the craft, near the stern. They have identical dimensions and are rotated with the same speed, but in opposite directions, so as to balance the unavoidable side push exerted by the rotating blades.

Tests made with this new method of propulsion revealed that the vane wheels gave the same speed as twin screw propellers with 41 per cent less shaft horsepower. This is principally due to the fact that the wheels are only partly immersed, while the shafts and hubs are above water, and therefore exert no resistance by friction. The vane wheels also have the advantage of great maneuvering power; they turn the ship around its own center.

Suction Tool Cleans Full Swimming Pool

REMOVING dirt and sediment from the bottom and sides of an indoor swimming pool, without draining the water from the pool, is possible now with the perfection of a suction tool resembling a vacuum cleaner.

The cleaner is attached to a long, flexible hose, one end of which is coupled to a permanent plug in the side of the pool. The narrow suction slot of the tool is armed with a stiff brush that scrapes sediment from the borders of the tank. Suction is produced by an electric or gasoline pump.



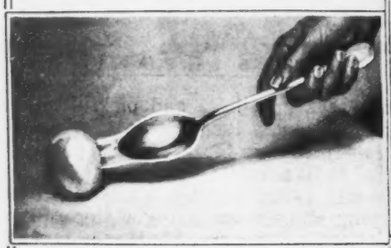
Dirt, loosened by a stiff brush, is sucked through the cleaner

New Electrical and Mechanical Devices to Lighten Housework

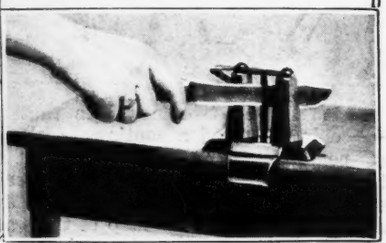
Pressure with one finger is all that is required to turn this novel egg beater. A spring does the rest

Three electric service outfits, into which anything from electric fan to sewing machine can be plugged, make the portable wired table, shown above, a real household servant. The top is just large enough to hold electric table appliances

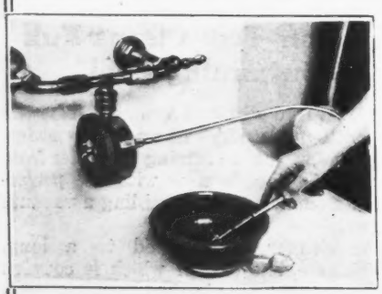
A twisted wire, supplied with a handle, whirls the sickroom thermometer rapidly, eliminating the bother of shaking



In baking meat, where constant basting and turning are required, the housewife will find this combination aluminum spoon and fork particularly useful

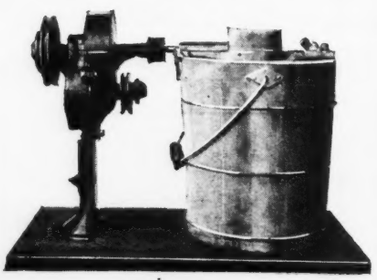


Against two cone-shaped, rotatable stones of this novel sharpening device, the knife blade is passed back and forth. The base is clamped to the table



Water from two faucets, rushing through this utility motor, generates power to operate utensils for grinding or polishing, beating eggs, or washing bottles. The spent water empties into the sink

THE Editor will be glad to supply, whenever possible, the names and addresses of manufacturers of devices mentioned in this and other issues of *Popular Science Monthly*.



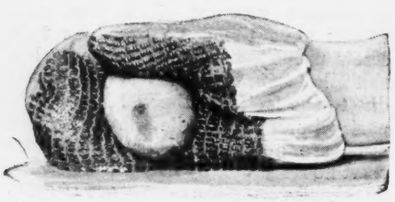
An electric washing machine motor can be made to turn the ice-cream freezer by the use of this geared countershaft, which, through a series of pulleys, can impart a variety of speeds

© U. & U.

This jelly bag is pulled through a wooden grip before the hot juice is poured. To squeeze the bag, the grip is pulled down

Shaped to fit the contour of the hand, the iron handle shown above was designed to take drudgery out of ironing day

Breakfast can be cooked on the dining-room table that is wired for plugging in the electric toaster or cooker



Armored with sharp edges of copper, this novel glove rubs and scrapes the skins from potatoes

Receptacles for powder, creams, and other beautifiers are sunk in the top of this convenient dressing table

Steel Fence Post Screws into the Ground

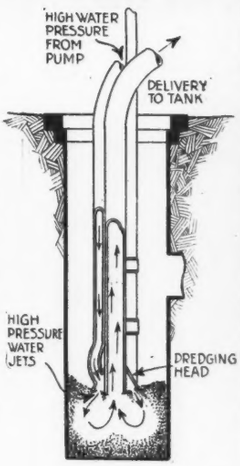
MUCH of the drudgery of fencing has been eliminated by the invention of an auger-like steel post that screws into the ground and is locked firmly in position by a vertical plate attached to the post, working equally well in hard or soft ground.

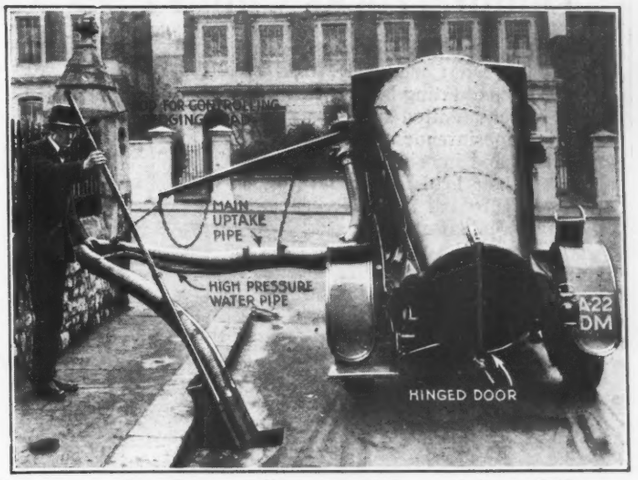
A steel lever, sharp at one end, is used first to start the post into the ground, and then is attached as a lever in turning the bit.

When the post has penetrated the ground as far as the vertical plate, a few taps start the plate into the soil and at right angles to the line of fencing. The plate is then pulled into the ground by further turning of the post.

Turned by a long lever, the auger-like fence post bores its way into the ground

One Tank of Water Cleans Four Manholes





Water from a high pressure pipe churns sediment in the manhole. This sediment is sucked back to the tank through a larger pipe, as shown in the diagram at the left

THE work of cleaning sewer manholes is now greatly facilitated by a recently invented transportable apparatus, consisting of a conical inclined tank, a force pump and a suction pipe, which will flush four manholes with 400 gallons of water—the amount usually required to clean one.

This saving is effected by the use of the same water again and again.

The tank is mounted at an angle of about 45 degrees on a three-ton motor chassis, which also carries a powerful pump, driven by the engine. The tank is filled with water, which is drawn out by the pump and forced through a small pipe lowered to the bottom of the manhole to be cleaned. The force of the water issuing from the nozzle of the pipe breaks and churns the sediment at the bottom of the manhole.

The liquid mud is then drawn by suction through a large, flexible hose to the tank and deposited there. The solid parts of the mud settle to the bottom at the smaller end of the cone, while the water is used again, in a similar manner, to flush three other manholes.

From time to time the accumulation of sediment or muck is removed from the tank by opening a trapdoor at the bottom.

The force of the water above quickly removes the mud adhering to the sides of the tank.

Wheel Anchors Protect Autos in Transit

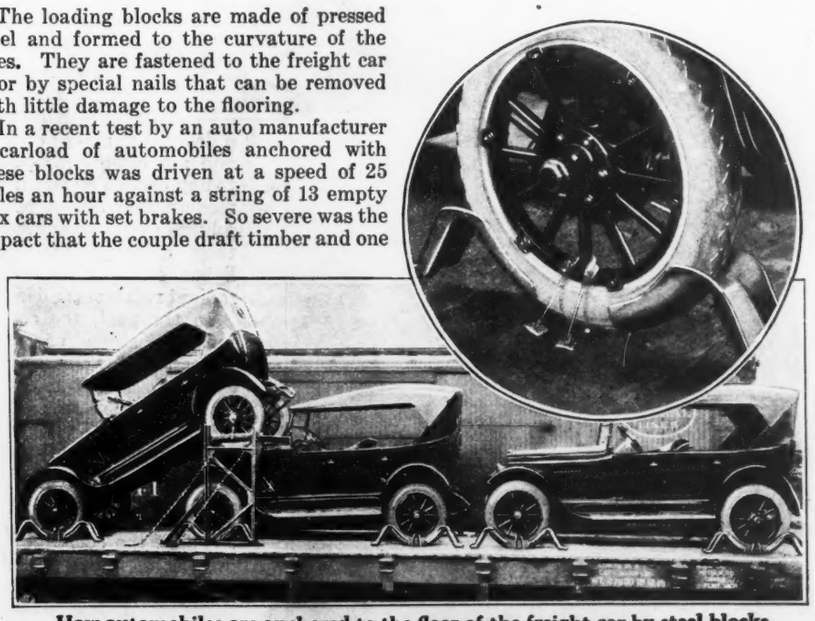
BY USING newly designed curved-steel blocks to hold the wheels of automobiles while in transit, manufacturers claim to have reduced loading and unloading costs, besides practically eliminating claims for damages after the machines have reached their destination.

How Loading Blocks Are Built

The loading blocks are made of pressed steel and formed to the curvature of the tires. They are fastened to the freight car floor by special nails that can be removed with little damage to the flooring.

In a recent test by an auto manufacturer a carload of automobiles anchored with these blocks was driven at a speed of 25 miles an hour against a string of 13 empty box cars with set brakes. So severe was the impact that the couple draft timber and one end of the first box car were demolished, but examination showed the machines had withstood the shock without a trace of damage.

The blocks are 10½ inches high and weigh 10 pounds each. After the machines have been delivered, the dealer returns the set of eight blocks to the manufacturer at a cost of about 40 cents.



How automobiles are anchored to the floor of the freight car by steel blocks that fit the curvature of the tire as shown in inset

Shackled Cow Can't Switch Her Tail, Nor Kick

WITH troublesome extremities securely shackled by a pair of steel cuffs, recently devised, the cow can't switch her tail at milking time, nor kick over the milk bucket.

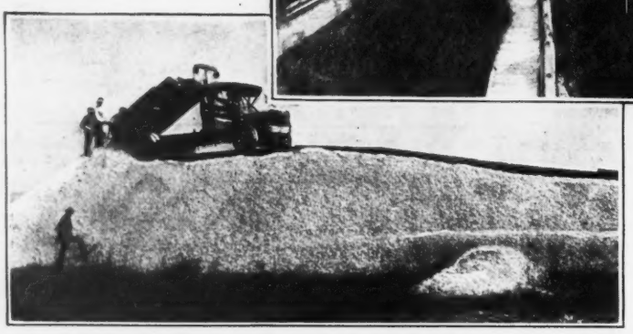
The device consists of two clamps, one of which fits tightly around the gambrel cord just above the hock of one hind leg, the other around the tail near the tassel. The two clamps are connected by a short chain.

The Editor will be glad to supply, whenever possible, the names and addresses of manufacturers of devices mentioned in this issue

Dump Trucks Climb Piles They Build

IN THE course of a big road construction job, near Carbondale, Ill., a problem of accumulating large quantities of material in a limited space, was solved by the superintendent in charge by a novel method in which trucks, as they dumped their loads, formed their own roadbed on which they climbed as the height of a pile increased.

He started the pile by dumping the material from big trucks and then placed wooden tracks on top. The trucks, backing up the track, dumped more material, which in turn was used as the foundation for an extension of the track.



At the right: A truck dumping its load at top of pile after climbing the ingenious wooden tracks shown above

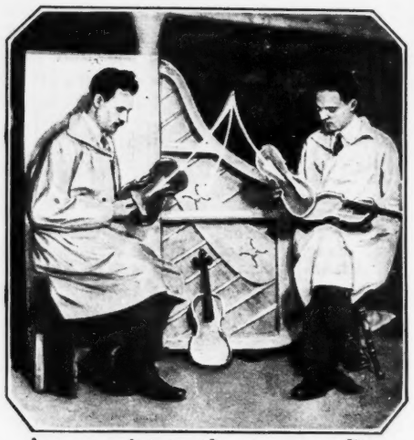
With the aid of these runways it was possible to build piles 100 feet long and 15 or more feet high.

Each track unit consisted of two 10-foot timbers, across which were spiked planks. On one edge of each runway unit a 4 by 4 inch timber was bolted down to form a guard.

Tone Amplifier Improves Stringed Instruments

FOR the first time since the days of the great master builders of violins, an invention recently developed promises to bring a revolutionary improvement in the tonal qualities of any stringed instrument to which it is applied.

The device, which takes the place of bass bar and soundpost, consists of a long wooden strip carefully fitted and glued to the inside of the top board of the instrument, directly underneath the G string. To this strip a small sounding board is attached by two feet. This device may be attached to any stringed instrument.



Arrows point to the new sounding board, as placed under top of violin, and to piano sounding board

Blindfolded, He Assembles Typewriter in an Hour

TO DEMONSTRATE his expert skill as a typewriter mechanic, F. R. Scroggins, of San Antonio, Tex., recently sat blindfolded at a table in a show window, with a typewriter before him, and dismantled the machine completely in 11 minutes and 15 seconds. Then, still blindfolded, he reassembled the machine in 56 minutes and 30 seconds.

To prove that the task wasn't difficult for him, he repeated the performance three successive times in a period of five hours.

Scroggins' remarkable feat demonstrated that repairing typewriters is one of the few professions in which the blind can find remunerative employment.

Never Too Cold to Snow

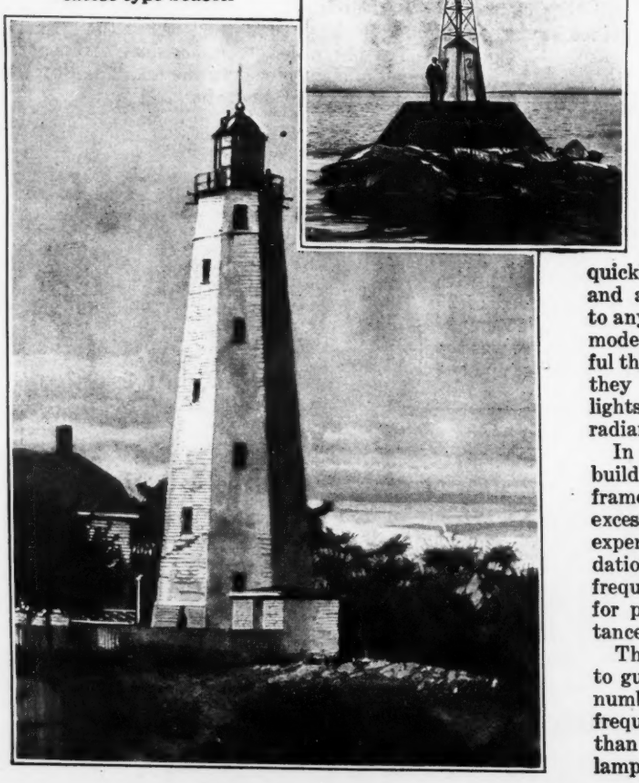
SCIENTIFICALLY speaking, it's never "too cold to snow," says S. K. Pearson, Jr., of the United States Weather Bureau.

"We all know," he tells us, "that it snows in parts of Canada and in our Northwest when the mercury registers far below zero. Our worst blizzards have either commenced with a very low temperature or terminated with the mercury near zero."

Beacons Built on Reefs Replace Old Towers

NEW standard lighthouses, consisting of a superstructure of iron mounted on a solid concrete base that can be placed directly over a reef or other danger spot, are now supplanting stately towers of the the past—towers that, while they were picturesque, often were built miles away from the treacherous ledges they marked, and thus provided inadequate protection for shipping.

Below: the oldest lighthouse in America, at Sandy Hook, N. J., built in 1884, and at right, the latest type beacon



The new beacons, adopted by Uncle Sam's lighthouse service, are supplied with electric current by heavy cables from the mainland. They can be built quickly at small expense and are easily transported to any desired location. The modern lamps are so powerful that even without lenses, they outrange the older lights with their superradiant reflectors and lenses.

In the past, the cost of building stone or metal framework towers has been excessive. The tremendous expense of setting foundations for high towers has frequently been responsible for placing them at a distance from the danger spots.

The present tendency is to guard the coastline by a number of lights placed at frequent intervals rather than by a few powerful lamps placed far apart.

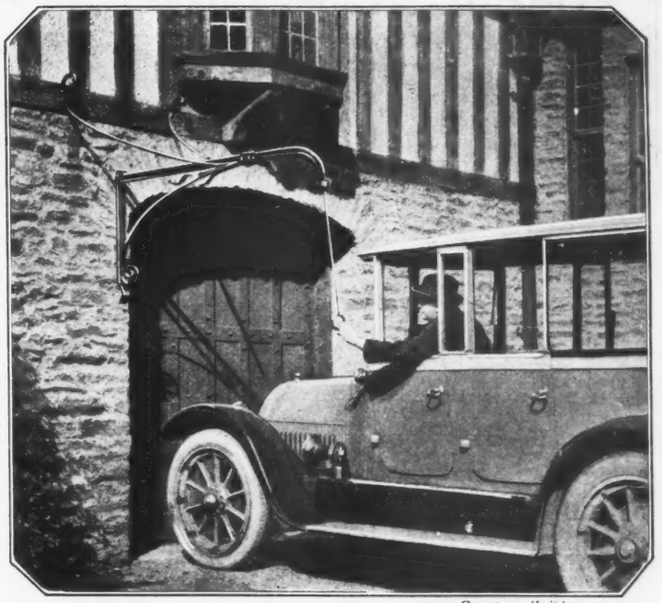
This Farm Gate Is Always Open to Motorists

FARM gates in certain sections of Florida are like railroad cattle guards, always open for an automobile or a man on horseback, but impassable to cattle or other animals with divided hoofs. The gate is made in the form of a grating of two-by-fours, 2½ inches apart, with the earth dug away beneath.

Autoist Opens Garage Door from His Seat

WHEN Claire Briggs, the famous cartoonist, drives up to his garage at New Rochelle, N. Y., a pull on a handy chain outside the door opens the door for him without his moving from his seat.

A chain suspended from a bracket extending 10 feet from the wall passes over a pair of pulleys to a sliding door. Very little force is needed to slide the entire door to one side, as the weight of the door is carried on rollers, and the rollers are equipped with ball bearings.



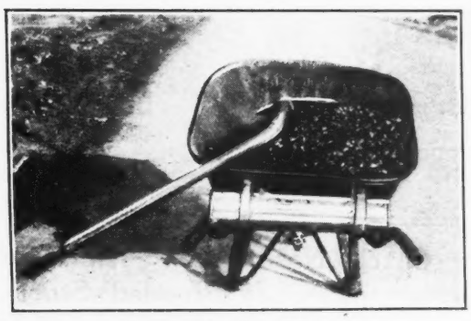
Courtesy *Building Age*

One tug on the chain, and the door slides open

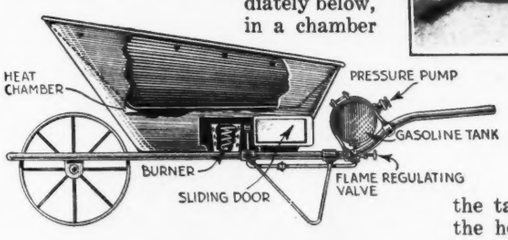
Wheelbarrow Heated for Winter Work

AMONG the most useful recent additions to the equipment of a road repairing outfit, especially during the cold season, is a gasoline-heated wheelbarrow for handling bituminous road material.

Supported on a frame of steel piping are two steel trays, one above the other. The upper tray, with a capacity of three cubic feet, holds the material to be heated and transported. Immediately below, in a chamber formed between upper and lower trays, is a gasoline heater.



The heater for this wintertime wheelbarrow is beneath the material tray and is fed by pressure pump from a tank between the handles



Between the handles of the barrow is a cylindrical tank that holds two gallons of gasoline, enough to heat the material in the tray for 10 hours continuously.

A small pipe conducts the gasoline from the tank to the burner and is admitted to the heating coil through a needle valve that regulates the supply of gasoline and hence the heat. A small air pump attached to the gasoline tank keeps the fuel under pressure. In the outer tray, openings for admitting air and for permitting the exhaust gases to escape are provided.

Material can be dumped without interfering with the operation of the heater.

WHERE is America's paper supply to come from after our pulpwood forests, now being shorn of timber at the rate of 100 acres a day, have been exhausted? Read, in next month's issue, the fascinating story of "henequèn," the superabundant Mexican hemp, that is even now producing paper in commercial quantities.

Cigarette Holder also Holds Ash Tray

FOR the protection of rugs from the ashes that cigarette smokers are in the habit of dropping, a small aluminum attachment has been invented that may be clamped to any cigarette holder, and is so light that its weight is hardly noticeable to the person who is using it.

© K. & H.

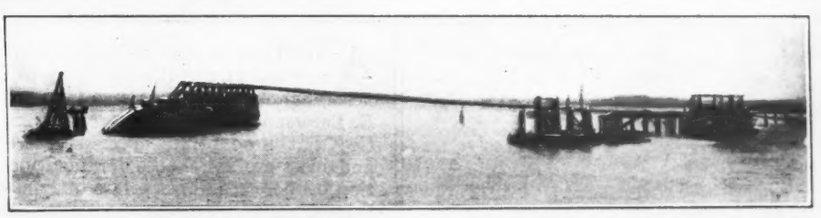
This tray catches all cigarette ashes

It is in the form of a trough, closed at one end and clipped firmly to the end of the holder.

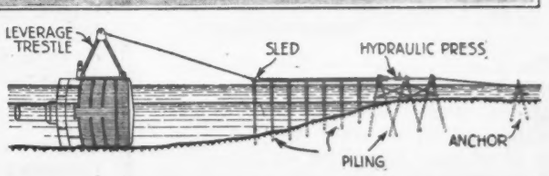
How Sunken Steamer Was Floated by Cables from Shore

BY MEANS of a series of hydraulic presses exerting force simultaneously through a multitude of cables, the 8000-ton German steamship, Gneisenau, sunk on its side in the outer harbor at Antwerp, was pulled back into upright position recently and floated to drydock.

A trestle consisting of 12 iron levers was fitted to the portion of the port side remaining above water. To these levers were attached 48 steel cables terminating at the shore end in 12 hydraulic presses having a total capacity of 3000 tons. A system of balances enables the engineers to make the 12 presses act simultaneously.



Pulled by hydraulic presses, cables attached to a trestle of levers fitted to the exposed side of the sunken ship, raised the vessel to an upright position



Tractor Scraper Shaves Ice for Skaters in Chicago Parks

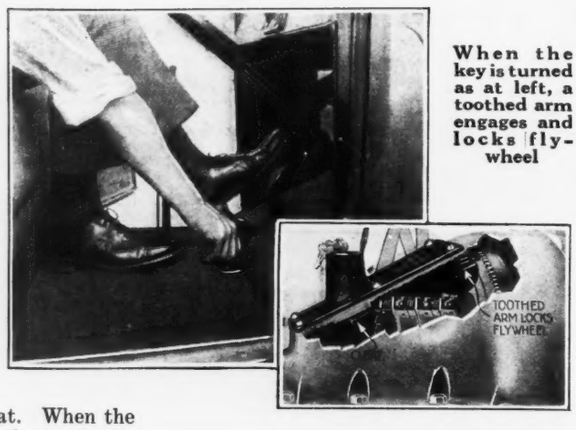
ICE on the lakes in Chicago parks will be shaved smooth for skating this winter by a scraping machine of novel design, drawn by a small tractor. The machine, driven by a gasoline engine, is mounted on a V-shaped frame, attached to the tractor by a stiff bar bolted to the apex of the V. Each of the two arms of the V is supported by a wheel.

Mounted on a V-shaped frame and hauled by a tractor, nine motor-driven rotary cutters shave all bumps from the ice

The frame supports nine rotary cutters with horizontal blades that rest directly on the ice and are rotated by worm-gear transmission from the gasoline engine. It is expected that this machine will do the work heretofore done by 10 teams of horses.

New Transmission Lock Safeguards Ford

MAKING it impossible for a Ford to be started or moved under its own power, and yet permitting the car to be moved by hand in case of a fire or other emergency, a new transmission lock affords the protection against theft hitherto enjoyed only by owners of expensive cars.



When the key is turned as at left, a toothed arm engages and locks fly-wheel

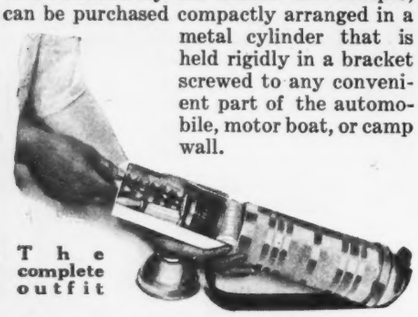
The lock is screwed on in place of the original cover of the transmission case, and its keyhole plate comes just above the floorboard, where it is easily reached from the driver's seat. When the key is given a quarter turn, the teeth of a steel arm connecting with the lock project and engage with slots in the gear ring of the fly wheel. This prevents the power plant from being turned over. At the same time, a second arm on the lock turns crosswise under the edges of the transmission case opening, so that the lock cannot be unscrewed and removed.

In the unlocked position, the toothed arm is held firmly to the rear, and cannot engage the gear ring while the engine is in motion, or until the proper key is used.

The lock may be installed quickly.

First Aid Outfit Fastens to Car or Motor Boat

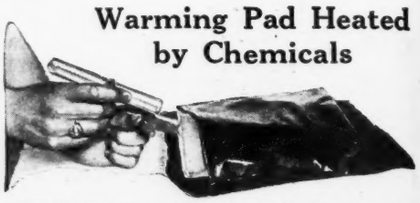
FIRST aid outfits containing a selected assortment of medical supplies likely to be needed by the tourist and camper, can be purchased compactly arranged in a metal cylinder that is held rigidly in a bracket screwed to any convenient part of the automobile, motor boat, or camp wall.



The complete outfit

The aluminum tray, 3⅝ inches in diameter and 11¾ inches long, contains cotton, bandages, needles, matches, caustics, plasters, and numerous other first aid requisites in addition to bottles for antiseptics and cleansing solutions. The ends of the tray are closed by two cups.

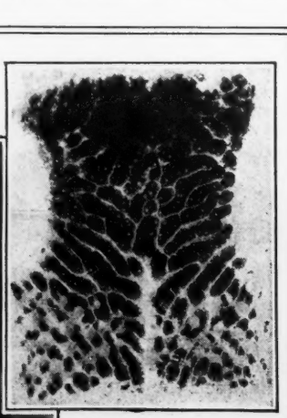
Warming Pad Heated by Chemicals



CHEMICAL action, instead of hot water or electricity, warms a heating pad of recent invention. The heat is produced by adding a small quantity of cold water, not more than one ounce, to chemicals contained in a stout canvas bag, which is inclosed in an outer bag.

The bag containing the chemicals and water is vigorously shaken and in a few moments the temperature rises to a maximum of about 200° F. If properly protected, the bag will remain hot for 24 hours.

Cattle Nose Prints, All Different, Identify Blooded Stock



Above is typical cattle nose print, obtained by pressing paper over the animal's inked nose

A SYSTEM of animal identification, evolved at the University of Minnesota under the direction of William E. Peterson, has shown in actual practice that nose prints of cows, calves, and bulls are as reliable for identification purposes as finger prints of human beings. The idea was devised principally to safeguard valuable blooded cattle entered for exhibition at shows.

The method of taking the nose prints is extremely simple. After the perspiration is wiped off the animal's nose with a flannel cloth, ink is applied to the nose with a stamping pad. The impression is made by rolling a piece of newsprint or mimeograph paper backed by a small board over the nose of the animal, beginning at the base of the upper lip.

Careful comparison shows that no two prints of different animals were exactly alike. It is also true that the markings on the nose of an animal do not change in pattern, although they become larger with age. This method is believed to offer a positive means of identification, of particular importance in preventing substitution of pure bred stock.

How to Tune Up Your Car and Save Money

Farmer-Sculptor Carves Statues from Hillside

ALTHOUGH Daniel Brice Baughman, a farmer and undertaker of Black Run, Ohio, never has had a lesson in sculpture, he has chipped for more than 20 years at the limestone that he quarries out of the high hill upon which stands his home.

Now, at the age of 45, he has laid out on this hill a memorial park, dedicated to great

With chisels forged by himself the farmer-artist carves statues in limestone

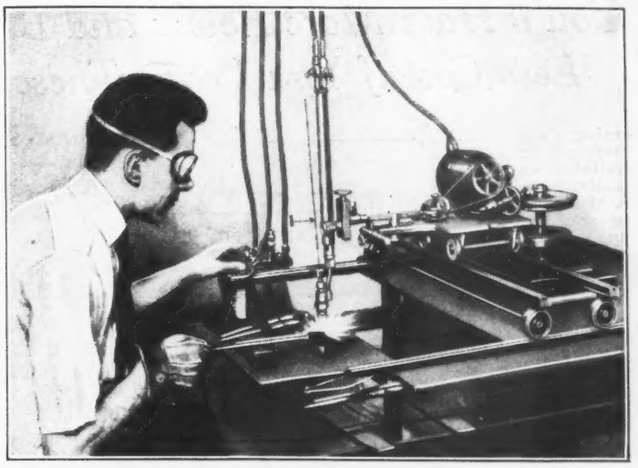
Americans and the veterans of our wars. In this park are his statues of Washington, Lincoln, Garfield, McKinley, McPherson, Grant, Sherman, and "The Doughboy."

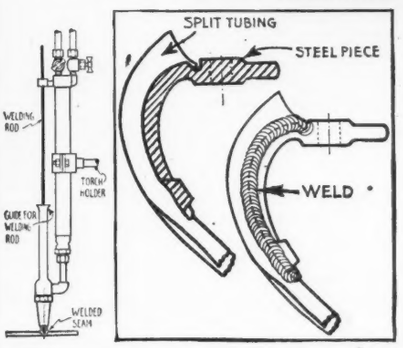
Baughman not only quarries his own stone, but in his own forge makes the many chisels with which he shapes the stone. He sets up the huge stones in the rough and puts on the final touches from a scaffolding. Then he paints them white, so that they stand out like marble.

Automatic Welder "Sews" Metal Seams

WITH an ingenious welding machine recently developed, metal parts are welded together automatically in curved or straight seams, in a manner closely resembling the sewing of a seam on a sewing machine.

The welding machine has two torches—a





Above, an operator at the automatic machine, welding a drop-forged steel piece of varying thickness to a curved piece of split tubing of uniform thickness, as in diagram at left. Note that the line of welding is an irregular curve. Diagram at the extreme left shows arrangement of parts of the welder

preheating torch, which moves steadily over the center of the seam, bringing the metal nearly to the fusion point, and immediately following it a self-feeding welding torch that has a slightly circular motion. This motion causes the welding rod to oscillate from one side of the seam to the other. Both torches are fed by flexible gas tubes and both are supported by a carriage that also carries the motor and the mechanism propelling the carriage along its track.

The track frame also rests on wheels that run on a track at right angles to the track of the carriage. This arrangement makes it possible to move the torches along any straight or curved line, in any direction, if guided by a fiber template.

Both torches are independently adjustable as to heat, height and inclination, and the progress of the carriage along its track can be controlled with accuracy by the operator. The rotary motion of the welding torch can also be regulated by changing the friction drive and the eccentric.

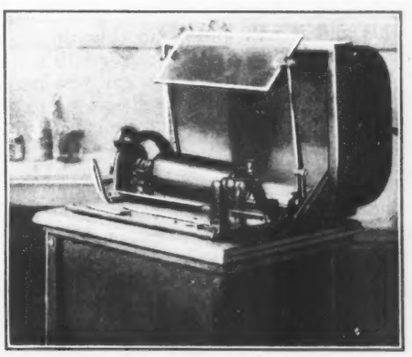
Three-Inch Radio Set Has 25-Mile Range

The designer, Frank L. Copeman, receiving with his compact set, shown in detail at right

WITHOUT sacrificing clearness of tone and wave capacity, Frank L. Copeman, of New York City, has perfected a remarkably compact and neatly designed radio receiving set. By a patented method of multiple coil winding he has succeeded in confining the switch controlled tuning unit into a small space without destroying its selective qualities.

Although arranged primarily as a crystal detector set, the tuner can be used in a vacuum tube circuit. Speech and music are clearly received within a radius of 25 miles of a broadcasting station. In fact, it is claimed that the baby set is more effective than many larger instruments.

The outfit, exclusive of phones, is three inches long, two inches wide, and two inches high—so small that several of them could be held in one hand.



Shield Guards Shaver of Dictating Records

TO PREVENT flying pieces of wax dictating machine cylinders, broken while being shaved, from injuring the operator, M. G. Hoyman, of Neenah, Wis., has invented a new safety guard.

The guard is a plate glass shield that may be adjusted by means of two pivoted telescoping arms.

In three minutes' time the guard can be fastened to the bed plate of the shaving machine by removing two bolts that form a part of the machine and inserting the same bolts through the base of the guard.

compression stroke, is half an inch below

How to Tune Up Your Car and Save Money

You'll Have More Power and Better All Around Performance at Less Cost if You Learn These Lessons from the Race Driver

10 H.P. AVAILABLE
BEFORE YOU TUNE UP YOUR CAR
YOU NEED 7 H.P. MERELY TO PROPEL YOUR CAR
YOU HAVE ONLY 3 H.P. IN RESERVE
IN THE UNTUNED CAR YOU GET LESS THAN 15 MILES TO THE GALLON

Assuming that 10 horsepower is available at 20 miles an hour, the running gear of the untuned car absorbs seven horsepower

Only three horsepower remain for acceleration and hill climbing. Note, below, how the dark horses increase as the car is tuned up

IF YOUR car labors on the hills; if your engine lacks "pep" or your car lacks "kick;" if your gasoline bills are too high or your tire mileage too low; if you are getting too little fun out of your car at too great cost; or if it is not as reliable a business utility as you expected:

You should hearken to the methods of the race driver, because he is a super motorist. Most of the things he does to squeeze a heartbreaking maximum speed from his fleet mount, may be applied with almost equal effectiveness to make your own car

By Harold F. Blanchard

course will not only produce the greatest speed possible, but it will give maximum hill-climbing ability, maximum economy, and maximum reliability. Incidentally, the liveliness of the car will be increased to a surprising degree.

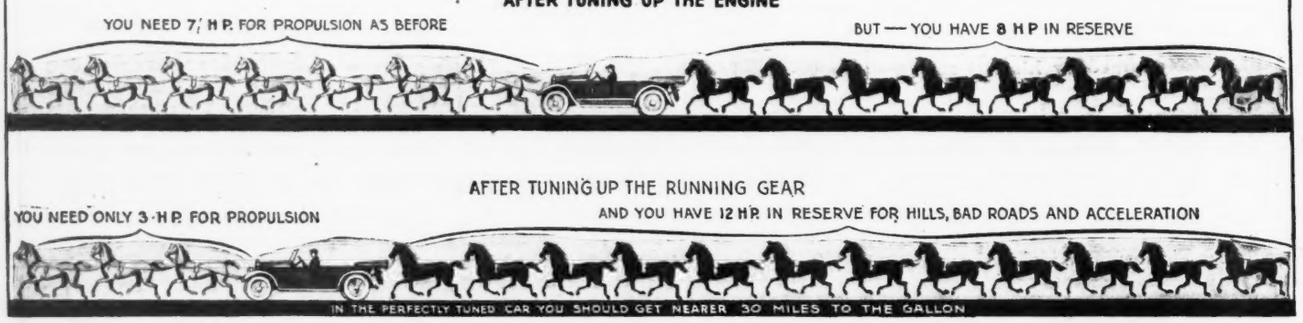
This quality of car energy commonly called "pep," like hill-climbing and speed prowess, depends on the amount of reserve power available. If you are running 20 miles an hour, the rate at which you can accelerate your car depends on how much reserve power is available at this speed. Suppose that at 20 miles an hour your engine develops 10 horsepower with the throttle wide open, and that of this amount the running gear, including tires, consumes seven horsepower. That leaves three horsepower for acceleration. It also means that the steepest hill you can climb on high gear is one that will absorb not more than three horsepower. If the hill is steep enough to require four horsepower, you must shift to second.

Now let us assume that by putting your engine into racing car condition its horsepower development at 20 miles an hour is raised to 15. With the running gear still absorbing seven horsepower, there is now eight horsepower available for acceleration or hill climbing. The reserve power has been nearly tripled by merely improving the condition of the engine.

Next, assuming that by giving careful attention to the running gear and tires, the power absorbed at 20 miles an hour is reduced from seven to four, the reserve horsepower is increased to 11, or nearly four times as much as was available originally.

These figures are by no means exaggerations. They merely prove how much is to be gained by a sensible application of race driver methods, which I shall endeavor to describe to you in detail.

The speed of the racing car mentioned at the outset was raised first from 45 to 60 miles an hour by putting the engine in good condition, then was increased again to a 75-mile pitch by minimizing frictional losses.


15 H.P. AVAILABLE
AFTER TUNING UP THE ENGINE
YOU NEED 7 H.P. FOR PROPULSION AS BEFORE
BUT — YOU HAVE 8 H.P. IN RESERVE
AFTER TUNING UP THE RUNNING GEAR
YOU NEED ONLY 3 H.P. FOR PROPULSION
AND YOU HAVE 12 H.P. IN RESERVE FOR HILLS, BAD ROADS AND ACCELERATION
IN THE PERFECTLY TUNED CAR YOU SHOULD GET NEARER 30 MILES TO THE GALLON

Tuning up the engine to develop 15 horsepower—with running gear still absorbing seven horsepower—gives you eight horsepower in reserve

Finally, with running gear tuned up to absorb only three horsepower, your car is in perfect trim, with 12 reserve horsepower for acceleration and hill climbing

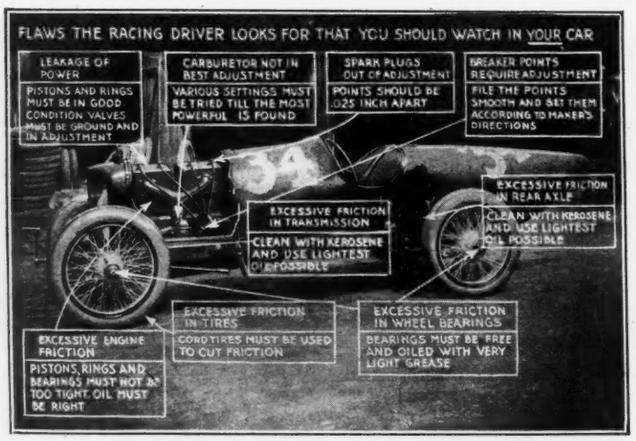
physically fit. Tune up your car as he tunes up his and it will glide smoothly up the steepest hills; fuel, oil and repair bills will be noticeably reduced; the car will last longer and breakdowns will be almost wholly eliminated from the sum of your automobile experiences.

If a race driver, by a deft touch here and there, can increase the speed of an ordinary touring car from 45 to 75 miles an hour, there is no good reason why the average automobile owner, once he has mastered the few important secrets of power saving, cannot raise the tune of his car to that same 75-mile pitch, gaining the additional 30-mile speed that means motoring perfection, and reducing repair and maintenance costs to a minimum.

No Mystery Here

There is nothing mysterious nor difficult about the methods of the race driver. Any motorist may apply them to his own car with success without spending too much time or effort.

First, the engine must be tuned up to give its maximum power; then all friction losses in engine, chassis, and tires must be reduced to the limit. Such a


FLAWS THE RACING DRIVER LOOKS FOR THAT YOU SHOULD WATCH IN YOUR CAR
LEAKAGE OF POWER
PISTONS AND RINGS MUST BE IN GOOD CONDITION VALVES MUST BE GROUND AND IN ADJUSTMENT
CARBURETOR NOT IN BEST ADJUSTMENT
VARIOUS SETTINGS MUST BE TRIED TILL THE MOST POWERFUL IS FOUND
SPARK PLUGS OUT OF ADJUSTMENT
POINTS SHOULD BE .025 INCH APART
BREAKER POINTS REQUIRE ADJUSTMENT
FILE THE POINTS SMOOTH AND SET THEM ACCORDING TO MAKER'S DIRECTIONS
EXCESSIVE FRICTION IN REAR AXLE
CLEAN WITH KEROSENE AND USE LIGHTEST OIL POSSIBLE
EXCESSIVE FRICTION IN TRANSMISSION
CLEAN WITH KEROSENE AND USE LIGHTEST OIL POSSIBLE
EXCESSIVE FRICTION IN TIRES
CORD TIRES MUST BE USED TO CUT FRICTION
EXCESSIVE FRICTION IN WHEEL BEARINGS
BEARINGS MUST BE FREE AND OILED WITH VERY LIGHT GREASE
EXCESSIVE ENGINE FRICTION
PISTONS, RINGS AND BEARINGS MUST NOT BE TOO TIGHT. OIL MUST BE RIGHT

Here are the enemies of speed and "kick" that the race driver tackles when he "tunes up" for a speed contest. Any automobile owner can profitably follow his methods

First, Grind the Valves

Obviously the first step in tuning up the engine is to grind the valves and remove the carbon. Then adjust the valves, allowing .006 inch clearance for the exhaust and .004 for the intake. Any weak valve springs should be replaced.

On a racing car the spark would be timed so that with lever retarded the breaker points of the interrupter that break the spark connection would begin to separate when the piston, on the

compression stroke, is half an inch below top dead center; but the average driver will be best satisfied if the points break just as the piston reaches top center. A car with a late spark will fail to develop full power, even if the lateness is not sufficient to cause overheating. The breaker points should be smooth and should meet squarely. Their adjustment should exactly conform to the recommendations by the manufacturer.

Watch Your Ignition

The battery should be strong, the coil and condenser in the best condition, the distributor clean inside and outside, and the high tension wiring well insulated. If the insulation is old or rotted, new wiring should be installed. High tension ignition current leaks readily and any leaks will prevent hot sparks at the plug points.

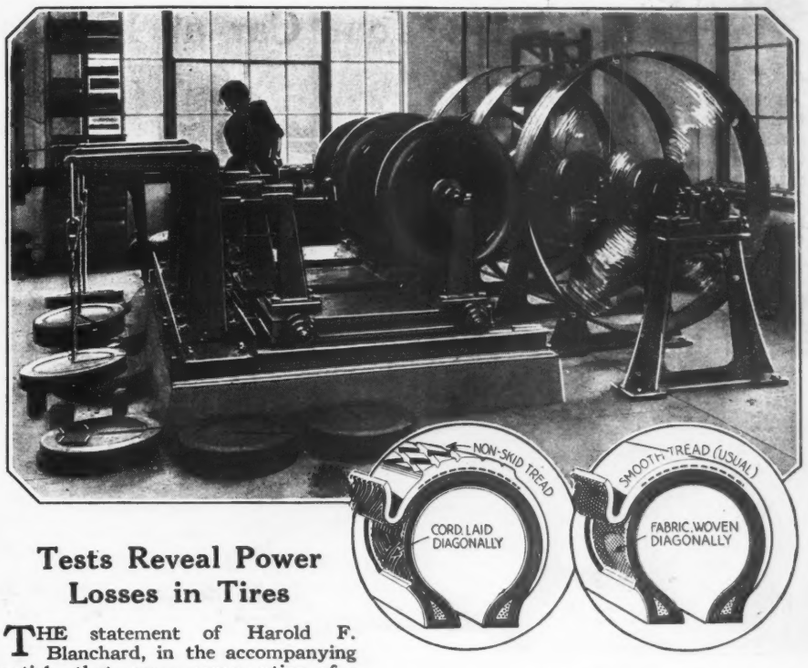
The spark plugs should be clean and the points set accurately .025 of an inch apart. This distance is approximately three eighths of a sixteenth of an inch, or half the thickness of a new dime.

The friction generated by pistons, rings and bearings is an extremely important item of power absorption to the racing driver. He fits pistons, rings and bearings somewhat loosely to minimize friction and eliminate the danger of these parts binding at excessive speeds. To compensate for the loose fit, he uses heavy oil. But heavy oil causes carbon to accumulate quickly in the cylinders and therefore is not suited to the needs of the average car owner. The lighter the oil, the less the carbon deposit. It is best, in the long run, to use oil recommended by the manufacturer, and to change it frequently—at least every 500 miles.

That Pesky Carburetor

The pistons should work freely and the rings should not press too heavily against the cylinder walls. Whenever new rings are installed, it is well to see that they offer a minimum of friction, and that the bearings are not drawn up too tightly by the repairman.

In carburetor adjustment, it is a good idea to remove the carburetor, clean it thoroughly and then install a gasoline filter in the line, to eliminate trouble with dirt and water in the fuel. There is a tremendous difference—as much as 25 per cent—in the way any carburetor will serve different engines. If you think that your present carburetor is not satisfactory, before trying another make, be sure that the one you have is in the best of condition and in good adjustment. You will save needless expense.



Tests Reveal Power Losses in Tires

THE statement of Harold F. Blanchard, in the accompanying article, that power consumption of a cord tire is less than that of a fabric tire, is interestingly corroborated by remarkable tire tests recently completed by the United States Bureau of Standards in its laboratory at Washington, D. C. In these tests, which conclusively demonstrated that cords absorb a third less power than fabrics, the tires were subjected to friction in an ingenious machine (shown above) that duplicated normal road conditions. Construction of the two types of tires is shown in the inset.

For the tests, each tire, attached to an electric dynamometer, is pressed into contact with a pulley driven by a 10-horsepower electric motor. The surface of the pulley corresponds to a smooth macadam road. By increasing the speed of the motor, the tire can be rotated at a speed equal to that of an automobile traveling 50 miles an hour.

A close approximation of the lost power is gained by computing the energy input to the pulley motor and the energy output of the dynamometer. Since the efficiency of the two electric motors is known, the energy loss is the difference between the two figures.

An average four-inch fabric tire under normal load and air pressure, was found to absorb approximately nine tenths horsepower at 25 miles an hour. Under similar conditions the power loss in a cord tire was six tenths horsepower.

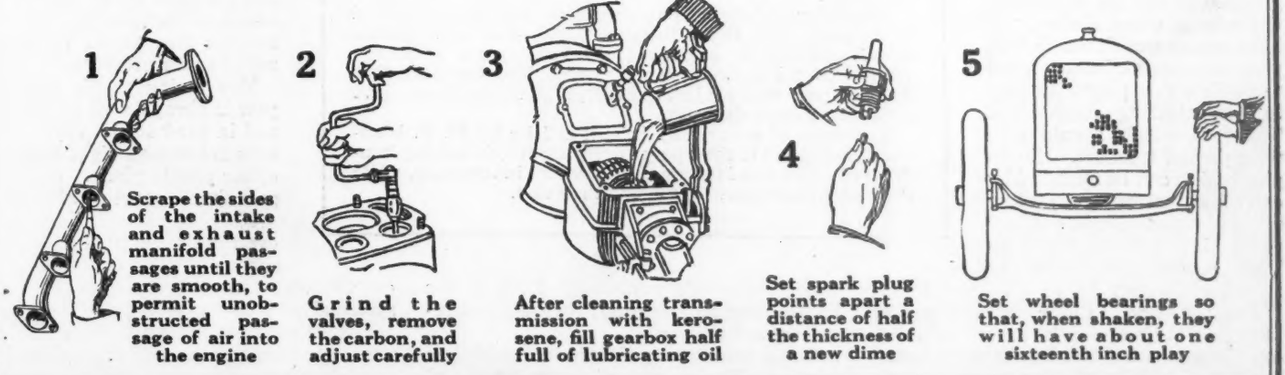
The column of air sucked into the engine through the carburetor and through the tortuous passages forming the intake manifold may be compared with an endless elastic rope. If the sides of the manifold are rough, it is clear that the rope cannot be pulled in as fast as if the sides were smooth. Therefore the intake and exhaust passages of a racing engine are scraped as smooth as possible. Car owners who will go to this trouble will discover at once an increase in power production at maximum engine speeds.

New pistons should be of light cast iron or of aluminum. Light pistons not only reduce vibration, but reduce pressure on the cylinder walls and bearings.

In tuning up the engine be sure that the spark advance mechanism works and that when the accelerator pedal is pushed all the way down, the throttle is fully open. Sometimes the extreme movement of the accelerator pedal brings the throttle past full opening to a slightly closed position.

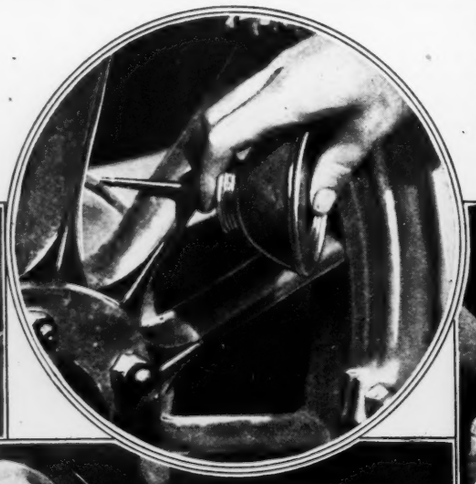
The clutch should not slip, even slightly. If it does, wash it with kerosene if it is a dry disk or plate type, and if this does not cure the trouble, adjust it. If the clutch is

Five Secrets of Car Tuning that Add to Reserve Power

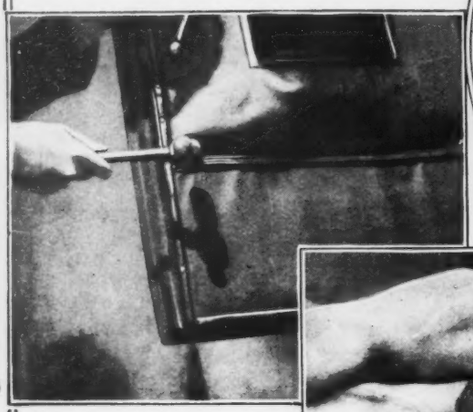

1
Scrape the sides of the intake and exhaust manifold passages until they are smooth, to permit unobstructed passage of air into the engine
2
Grind the valves, remove the carbon, and adjust carefully
3
After cleaning transmission with kerosene, fill gearbox half full of lubricating oil
4
Set spark plug points apart a distance of half the thickness of a new dime
5
Set wheel bearings so that, when shaken, they will have about one sixteenth inch play

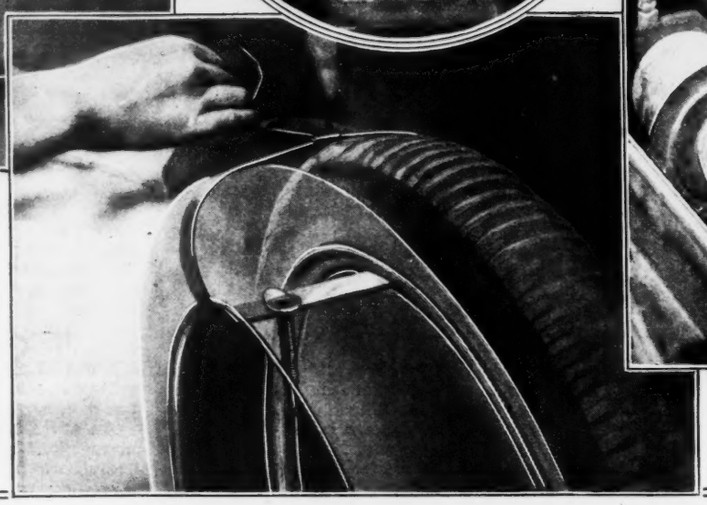
How to Keep Your Car at 100 Per Cent Efficiency

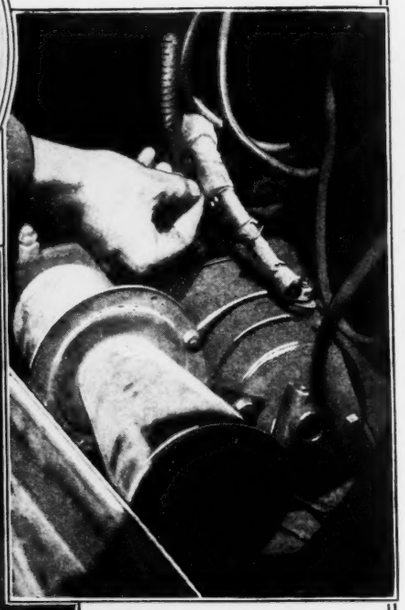
TO PREVENT the door pocket—the handiest place to carry automobile tools—from tearing away from the wooden crosspiece that forms its base halfway up the door, fasten the pocket with a row of carpet tacks, spaced about an inch apart. The tack heads can be concealed by tapping them into the beading of upholsterer's tape



SQUEAKY brakes can be remedied, without danger of lubricating the brake drum, by the use of fullers' earth. To apply, shake fullers' earth in gasoline, and before the fine powder settles, squirt it between the band and the drum with an oilcan







TWO spares are held on one tire carrier by a simple iron extension driven between the rim of first spare and tire carrier. Near the outside end of the extension, which projects far enough to support the second spare, shown in phantom at the right, drill a hole to receive the valve. Strap the tires together

WHEREVER the starter cable rubs against a metal part, wearing the insulation, bind a short twig to the cable

a cone, dust fullers' earth on the facing if it seems too oily, and adjust if necessary. A metal to metal multiple disk clutch that slips may be cleaned with kerosene and then covered with a lubricant consisting of a mixture of one part kerosene with one part cylinder oil.

The transmission should be drained, cleaned with kerosene, and partly filled with ordinary engine lubricating oil. If this leaks out, use a heavier oil. Treat the rear axle in the same way. If the lubricant leaks out around the wheels, the trouble usually may be eliminated by putting only enough oil in the axle to permit the big bevel gear to dip well into it. The wheel bearings should be lubricated with a very light grease.

The wheel bearings, if adjustable, should be set so that the wheels, when shaken, will have about one sixteenth inch play. Be careful, however, not to confuse this play with play in the steering mechanism. The rear wheels should spin with perfect freedom. Dragging brakes can be remedied by careful adjustment, according to the manufacturer's directions. If the brakes fail to release readily, joints may be rusted or it may be they require oiling.

Possibly some of the release springs may have lost their strength, broken or fallen off. In some cases it is advisable to install heavier springs, anchoring them to some convenient point on the chassis by three sixteenth inch wire. If contracting brakes are used on the rear drums, be sure that the small release spring located at the point where the band is anchored to the axle is in working order. Sometimes the screw at this point needs adjusting. Even if the brakes drag only slightly, they will noticeably retard the car.

Tires, when pumped hard, roll with less friction. The amount of power consumed varies with the tire. A few years ago one of the big tire companies produced a cord tire with smooth tread designed especially for racing. Actual tests by racing drivers on the wooden saucer at Sheepshead Bay, New York, proved that these tires on an automobile traveling 100 miles an hour were four miles an hour faster than other tires. Since approximately 100 horsepower is required to propel a racing car at this rate, it was estimated that the saving effected by these tires was equivalent to eight horsepower.

Every man in the racing game knows that power consumed by cord tires varies with the tire, but that the power consumption of the cord tire is always less than that of the fabric tire; further, that a tire pumped to 10 pounds in excess of manufacturer's rating absorbs less power than one with less air pressure.

The racing man's steering gear is always well lubricated and in good adjustment. The nuts are always tight and the cotter pins in place. Steering gear should get close attention.

Keeping your car in racing-car tune saves fuel bills and tire and repair expense. The car will wear longer because its parts are systematically lubricated. Once the whole car is "right," it is easy to keep it that way. And that is the way that gives the greatest satisfaction and economy.

Know Your Car

HAVE you ever asked yourself just how thoroughly you know your car and its ways? Do you realize how much greater mileage you could get for the same cost if you gave your car something like the care that the racing driver gives his? The racing driver not only tunes up his engine to give a maximum power output, but he also adjusts each detail of his car, so that the amount of power that it absorbs is at a minimum.

The difference between power produced and power absorbed is the power that is available for speed—that is, the power that is available for overcoming wind resistance. It is comparable to the business man's profit. You can take that profit on your own car just as easily, if you know how to give it the attention it deserves.

The series of remarkably helpful articles by H. F. Blanchard, appearing in these pages every month, is helping hundreds of readers to increase their pleasure in motoring, while decreasing the expense of running their cars.

Novel Automobile Robe Unrolls like Window Shade

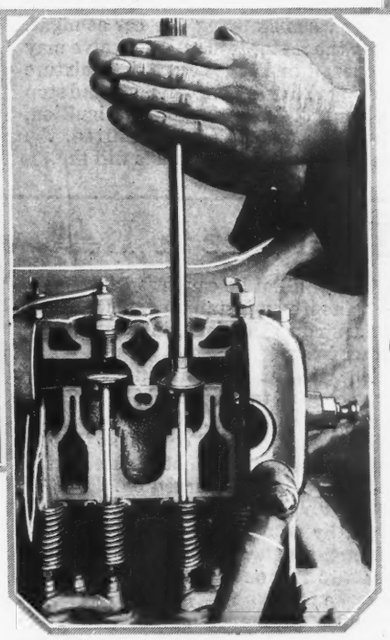
Ten Other Useful Inventions for Car Owners

This movable auto seat for the baby is hooked detachably to the robe rail in the back of the seat by means of two curved metal straps

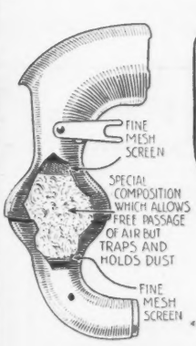
Long strips of rubber sponge may be used to advantage for cleaning the varnished or enameled parts of an automobile. Fold for packing

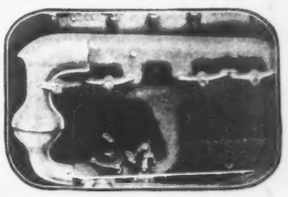
This automobile robe is pulled from its case like a roller shade and fastened. When released, a spring winds it around its spindle

For pouring oil, the attachment shown above, bolted to the manifold yoke, takes the place of a funnel

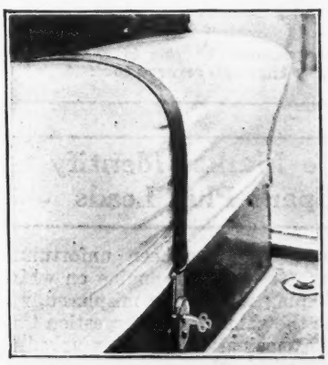


For lifting the valve from its seat while being ground, this long-handled suction cup holds up valve head

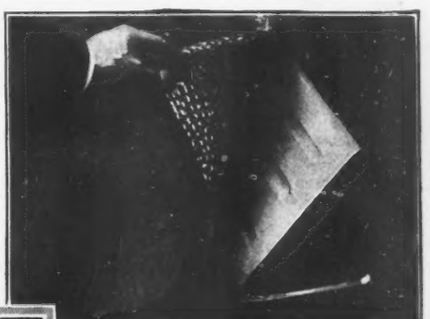




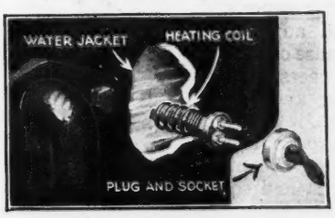
A novel dust arresting device, described in diagram, replaces the usual hot air pipe on the Ford, as shown, lengthening engine's period of usefulness



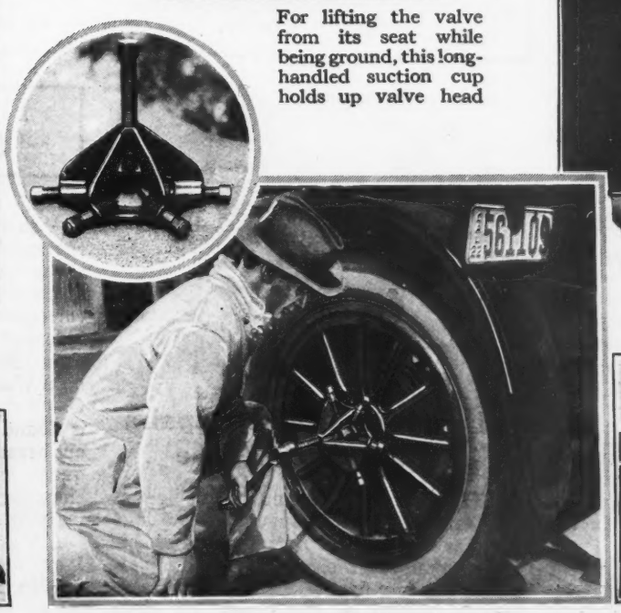
This steel strap, incased in leather and with a stout lock, will safeguard the tools in your seat chest



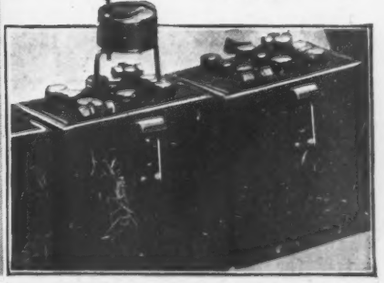
The auxiliary tank shown above is triangular in cross-section and, when covered, makes a good footrest



Installed at the base of water jacket, this electric heater keeps the engine from freezing



With six setscrews attached to the outside of the hub, this powerful screw, operated by a crank handle, enables one person to pull the tightest wheel



A new volt checker for storage batteries has two fixed contacts operated with one hand

Primer Made for Less than a Dollar

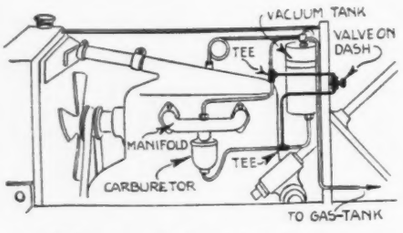
By G. W. Greene

WITH the first cold mornings, the motor-car owner begins to feel the need of some kind of a priming device to assure the quick starting of his motor. Probably the best system is one that provides for injecting gasoline into the intake manifold as near the cylinder block as possible, and preferably it should be operated from the dash.

For less than a dollar any one can fit such a primer to his motor, if it has a vacuum gasoline system. The vacuum tank is connected with the intake manifold by a copper tube.

Obtain two solderless tees of the proper size to fit the intake tube that carries gasoline from the vacuum tank to the carburetor as well as sufficient flexible metal tubing to reach from the manifold to the dash and back to the gasoline line. A small shut-off valve to fit this also should be purchased.

Cut the tube running to the manifold as far down as convenient. Fit in the tee, with the additional tubing running from it, and place the shut-off valve conveniently on the dash. Then, by means of the other tee, connect this tube with the gasoline line between the vacuum tank and the carburetor. The gasoline may be shut off while doing this by means of the shut-off valve on the bottom of the tank, or the tank can be emptied.



Valve on dash makes it easy to provide rich starting mixture

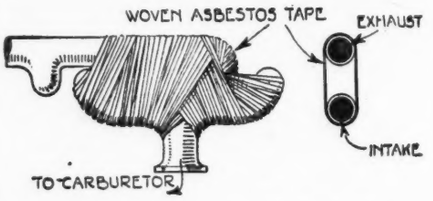
To use the primer it is necessary only to open the valve on the dash, allowing the suction of the motor to draw the liquid gasoline into the manifold. The best results can be obtained by opening the valve in the primer when stopping the car at night. When the motor is idling, the valve may be opened and the heavy rich mixture entering the cylinders will flood and stop the motor. Then turn off the ignition. When the motor is again started, the rich mixture in the cylinders will fire.

Asbestos Tape on Manifolds Conserves Heat in Winter

HEAT is the one necessary thing to turn raw gasoline into power. The illustration shown herewith explains a very simple aid to breaking up the fuel by wrapping both the inlet and exhaust manifolds with woven asbestos tape. This utilizes the waste heat of the exhaust pipe to heat fresh, cool, incoming gases.

Procure a quantity of woven asbestos tape at any automobile-supply house and wrap both as indicated. The asbestos, being a non-conductor of heat, confines the heat to the exposed surface of the intake.

Every motorist will agree that 90 per cent of starting troubles are caused by condensation of gasoline in the inlet manifold

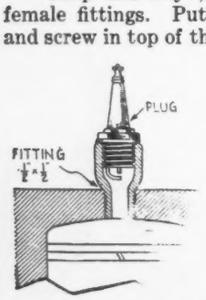


Warm air passes from exhaust pipe to intake manifold

in cold weather. The tape is wound neatly, one strip overlapping the other, so as to form a solid wall to keep the warm air in and the cold air out.—RONALD L. PRINDLE.

Raising Spark Plug Prevents Formation of Carbon

GO TO any hardware store or plumbing shop and buy ½-in. male and ½-in. female fittings. Put on plenty of shellac and screw in top of the cylinders in place of the spark plugs, then shellac your plugs and screw in the fittings. This raises the plugs in the fittings and protects them from the splash of the oil and the carbon from gasoline.



Keeping the spark plug clean means less engine trouble

I tried the above on my Ford and never had any trouble with dirty plugs. I believe it also gives more power to the engine. Be sure that the fittings are screwed on tightly.—EARL E. MOORE.

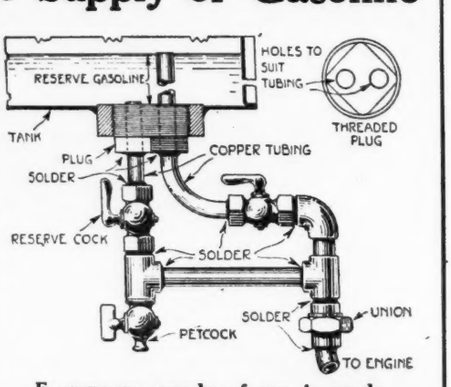
To Insure a Reserve Supply of Gasoline

YOU will not be caught without gasoline if you install the reserve device, illustrated at the right, in your auto or motor boat.

The plug at the tank outlet must be large enough to take the ¼-in. holes for the seamless tubing. One tube extends into the tank about 3 or 4 in. so that the gasoline below it cannot be used unless the reserve cock is turned on.

The amount of the reserve can be found by pouring into the tank known quantities of water or gasoline until it starts to run out of the pipe extending into the tank.

Solder all connections except at the union and where the plug screws into the tank.—HENRY S. LARABY.



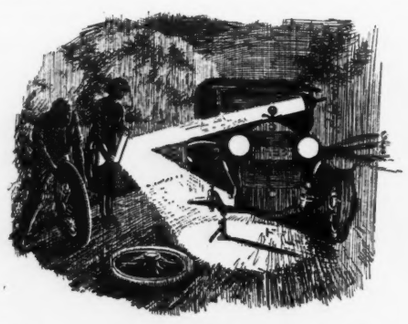
Emergency supply of gas is made available through reserve cock

Tool Made of Old Piston Ring Cleans Grooves

IN FITTING new rings to old pistons it is highly essential to clean the piston ring grooves of carbon and other accumulations. Otherwise, the new piston rings will not work properly because their freedom of movement will be restricted by the dirt in the grooves.

A useful homemade scraper

An excellent tool for thoroughly cleaning the grooves can be made from an old piston ring, a section of which is ground to a chisel edge and mounted in a handle.—H. F. B.



Mirror Aids Night Repairs on the Automobile

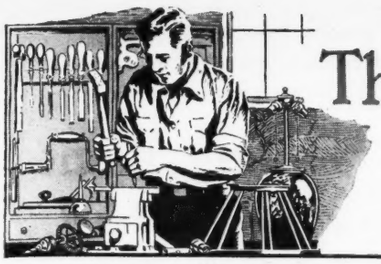
OFTEN when there is no trouble light at hand for making emergency automobile repairs at night, a mirror can be used in conjunction with the spotlight to illuminate practically any part of the car. The spotlight is focused on the mirror, by which the light is reflected to the spot where it is desired.—L. G.

File Marks Identify Spark Plug Leads

ANY one who has been unfortunate enough to crank an engine on which the spark plug wires were misplaced, will appreciate the value of the suggestion that spark plug terminals should be marked to correspond with cylinders of the engine. This method is used by a Washington, D. C., tractor owner and is found advantageous because of the frequent necessity for changing and cleaning plugs.

Marks correspond with cylinder

A V groove for No. 1 cylinder, two nicks for No. 2, and so on for all the leads, are made with a triangular file and will aid in reassembling.—G. A. LUERS.



The Home Workshop

New and Useful Things to Make with Tools

How to Make a Tea Wagon at Half Store Prices

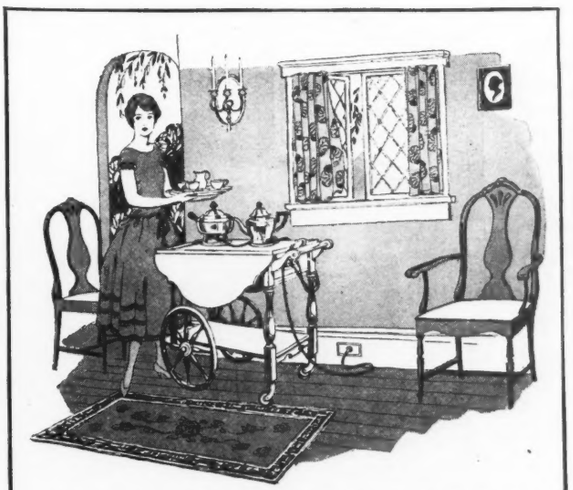
A Handsome Piece of Furniture for Your Home or a Useful Christmas Gift

EVERY woman who entertains, no matter how infrequently, wants one of those attractive tea wagons that are becoming increasingly popular in well furnished homes, serving often as informal luncheon tables. Not only are they ornamental, but they also save steps in carrying food from kitchen to dining room and in clearing the table after meals.

Exercise Care in Building

To make a tea wagon in your home workshop costs considerably less than to buy one, and if sufficient care is taken with the design, workmanship, and finishing, the one you build is apt to have the charm and distinction that give value to handmade furniture.

Success in building a tea wagon or any similar piece of furniture depends largely on having a good design and an adequate drawing or layout from which to work. For that reason the Home Workshop Department has prepared a blueprint giving additional details of the tea wagon the construction of which is described and illustrated in this article. This tea wagon combines the best features developed by furniture designers, simplified in construction as far as possible for the home worker who must rely almost entirely on hand tools.



A tea wagon of charming design and relatively simple construction, described in the accompanying article, for which additional working details are contained in Home Workshop Blueprint No. 13 **(See pages 90 and 91)**

A Wide Choice of Designs

Since this is a strictly conventional tea wagon of the more expensive type, the general dimensions and constructive details, many of them full size, can be used as a basis in making innumerable changes in design. For instance, the legs may be turned or straight, the leaves or tray may be omitted, and the handle may be of wood or metal, or a combination of both; the wheels may be purchased, turned, or cut out with a saw. Any number of these variations will be suggested in the accompanying illustrations and following text.

The general dimensions and construction are well illustrated on page 90 in the side and end views of the tea wagon, designed for the blueprint service. Commercial tea wagons do not vary a great deal in size, although the cheaper ones are often a trifle small and light. It is not the size so much as the design, material, and workmanship that influence the cost of manufactured tea wagons. They range in price from $20 or even less, but the average well built tea wagon costs between $30 and $40. An inlaid mahogany table, somewhat similar to No. 5 below, is listed in a New York department store for $90. The difference in the cost of material between a cheap and an expensive tea wagon is not a great deal, so it will pay the man who wishes to make one to work up one of the better models, which he can do at less than half the store cost.

Describing Some Wagons

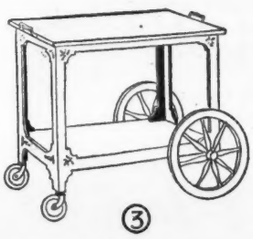
The design marked No. 1 is a novel and interesting variation in that the corners are cut off and the legs sawed from ½-in. stock, set at an angle. This displays well the distinctive profile of the legs without the appearance of thinness that would result if they were parallel with one of the main axes of the wagon. The leaves are rectangular in general shape, but have the outside corners cut off at an angle to harmonize with the top.

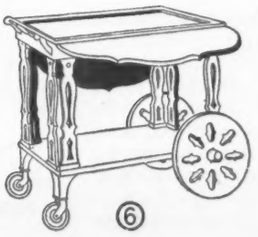
Number 2 is a little heavier tea wagon with 8 light, straight legs, each pair being set back a trifle from the corner. The small blocks at the bottom and top form a sort of base and capital for them. The middle shelf has the corners cut off between the legs, but the lower shelf is rectangular, like the top. This tea wagon has a wooden handle, and the tray has metal handles.

The Simplest Model

In No. 3 is illustrated the simplest and easiest model of them all. Two frames are made for the sides and two for the end, and the four are then fastened together with glue and brads. Cove-shaped corner blocks are used to

(*Continued on page 90*)





Any one of the nine handsome types of tea wagons shown herewith may be made as a variant from the Home Workshop's fundamental blueprint design

The following article contains specific instructions for installing fuel saving improvements in your heating plant, as recommended last month in a survey of the house heating problem

How You Can Improve Your Home Heating Plant

Cut Coal Bills by Better Distribution and Conservation of Heat

By James S. Godfrey

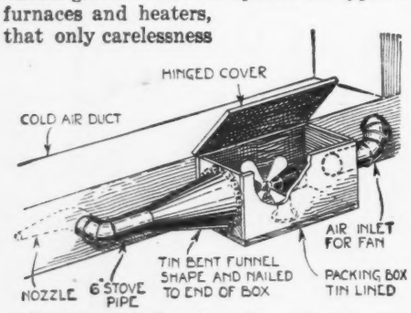
IN MANY ways the home worker can make improvements in his heating plant and his house that will repay themselves over and over again, both in the saving of coal and the increase of comfort during the winter.

The installations and methods suggested below have been tried and tested and none of them is too difficult or costly to be undertaken by any man with a little ingenuity and a few of the ordinary tools that are or should be in every household.

To decide just where to begin improving the heating arrangements of a house is often a problem. In many cases the efficiency of a heating plant can be increased from 25 to 50 per cent, with a corresponding reduction in the coal bill; in other instances it is next to impossible to better the heating arrangements without changing the plant entirely or remodeling the house. Generally speaking, increased efficiency can be obtained by one or more of the following methods:

1. Operating the furnace more economically.
2. Distributing the heat more thoroughly and evenly.
3. Preventing waste of heat.
4. Providing a proper degree of humidity in the air.

So much has been written and so much advice given on how to operate all types of furnaces and heaters, that only carelessness

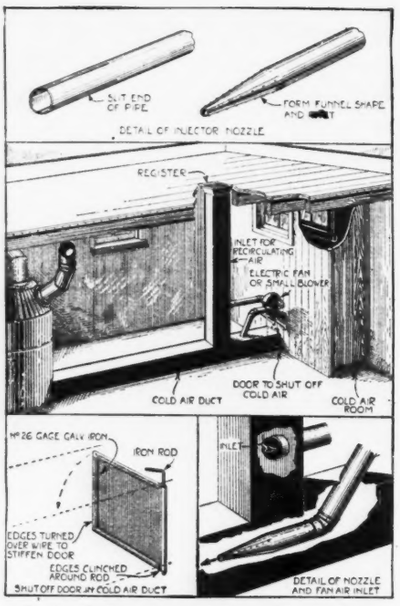


Fan placed in box alongside cold air duct

or indifference is responsible for losses due to poor regulation of the fire. In nearly every case, however, further improvement can be made by substituting automatic regulation by means of a thermostatic device. These are conducive to more even temperature throughout the house and prevent the losses caused by overheating at some times and allowing the fire to get too low at others. The home worker will find it comparatively simple either to install one of the commercial thermostatic regulators or to make one of his own as told in detail below.

Heat Distribution Is Problem

More important still is the question of distribution. Most warm air pipe furnaces, which constitute the larger proportion of heating plants throughout the country, are notoriously inefficient in this regard. Nine tenths of the difficulty encountered with these furnaces can be overcome by using a blower or fan to assist the recirculation of air through the radiator or hot air chamber. It is a simple matter to construct one

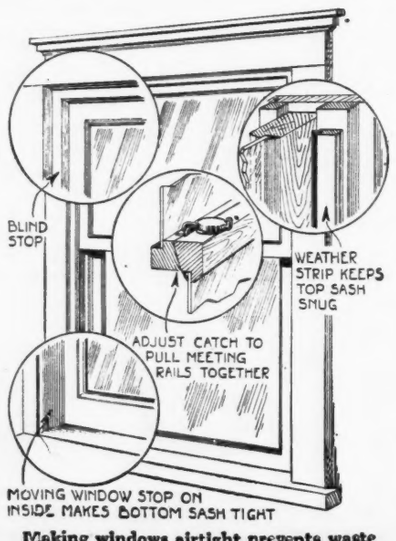

SLIT END OF PIPE
FORM FUNNEL SHAPE AND SLIT
DETAIL OF INJECTOR NOZZLE
REGISTER
INLET FOR RECIRCULATING AIR
ELECTRIC FAN OR SMALL BLOWER
COLD AIR DUCT
DOOR TO SHUT OFF COLD AIR
COLD AIR ROOM
No 26 GAGE GALV. IRON
IRON ROD
EDGES TURNED OVER WIRE TO STIFFEN DOOR
EDGES CLINCHED AROUND ROD
SHUT OFF DOOR IN COLD AIR DUCT
INLET
DETAIL OF NOZZLE AND FAN AIR INLET

Recirculating air with the aid of a fan. Details show how the injector and cold air shut off are made

of these injectors if electricity is available for operating a fan or blower, and the accompanying instructions and illustrations give a method that can be adapted for most furnace installations.

The conservation of heat is also of great importance. The home worker should go from cellar to garret looking for places where he can prevent the escape of warmth that represents actual dollars and cents. Where to look for these "leaks" and how to prevent them is graphically explained on a following page.

Still another source of waste lies in the fact that most homes do not have sufficient moisture in the air during the winter. More heat is required for comfort when the air is too dry and, therefore, any system of increasing the humidity will indirectly reduce the coal bills and at the same time make the house more comfortable and a healthier place in which to live. There are a number of ways of increasing the humidity and some of the best of these are described below. Instructions are also given for making a hygrometer for measuring humidity, for it is as difficult to preserve the proper degree of moisture in the air without means of measuring it as it is to keep the house evenly warmed without a thermometer.

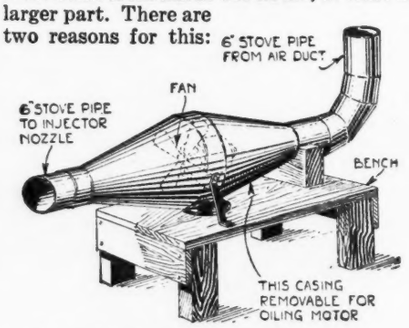

BLIND STOP
WEATHER STRIP KEEPS TOP SASH SNUG
ADJUST CATCH TO PULL MEETING RAILS TOGETHER
MOVING WINDOW STOP ON INSIDE MAKES BOTTOM SASH TIGHT

Making windows airtight prevents waste of heat

How to Install a Blower

To overcome most of the difficulties of the ordinary hot air pipe furnace, it is necessary to increase the amount of air passing through the furnace. This can be accomplished very simply with an ordinary electric fan or a ventilating fan or blower.

The best location for the blower is in or near the so-called cold air duct or inlet pipe. Obviously it is useless to make this installation if the inlet pipe leads directly from outdoors, because the fan then simply blows more cold air than usual into the furnace and decreases rather than increases the efficiency of the heating plant. The air must come from inside the house, at least in larger part. There are two reasons for this:



Casing of galvanized iron used for inclosing fan

one is that to force unduly large quantities of outside air through the furnace taxes it unnecessarily, and since the air has no means of outlet except through the window openings and door cracks, and the like, a high back pressure is created and hinders the correct distribution of the heat.

The first step, therefore, is to provide an indoor intake. This can be done by running a pipe of No. 26 United States standard gage galvanized sheet iron or a framework covered with tin, sheet asbestos or plaster boards, from a floor radiator on the first floor down to the regular intake pipe. The radiator should be located in some relatively cold corner, usually in the hall. A hinged or pivoted cut-off, as shown, can be arranged in the most convenient manner to permit either cold air, indoor air, or any proportion of the two being supplied to the furnace.

The next step is to provide for forcing a jet of air into the inlet pipe with a blower, which should not be placed too near the furnace. All that is necessary to do is to fit a conical casing in front of the fan, as illus-

(*Continued on page 100*)

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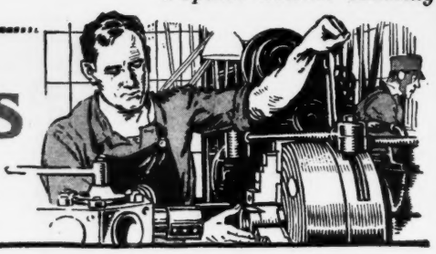


Shaper and Planer Attachment for the Lathe

Serves Many Purposes of Large Shaper at a Fraction of the Cost

By B. R. Wicks

MACHINE shops, tool rooms, and automobile repair shops will find the shaper attachment illustrated a valuable addition to the engine lathe. With its aid, shaping and planing operations of many kinds can be performed; slots, keyways, and splines can be cut, taps and reamers grooved, and all sorts of irregular, angular shapes machined.

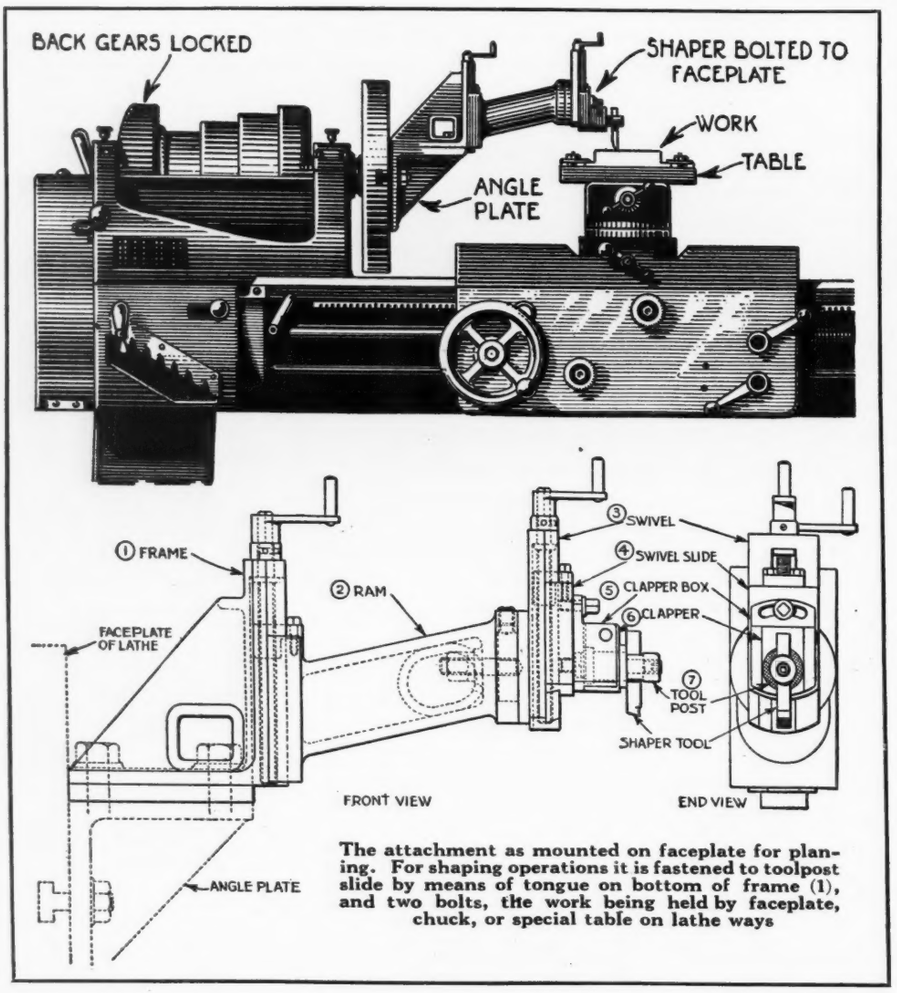
To obtain the maximum utility of range and action from the attachment, it has been designed for use in two different ways:

1. Mounted on the lathe faceplate, it machines work held on a table fastened to the compound toolrest. In this way it really serves as a planer, as the work is reciprocated beneath the tool.

2. Held in the toolpost, the shaper head operates on work fastened in a chuck or on the faceplate, or mounted on the lathe ways, resting on a table.

The utility of the shaper goes without saying, but many machine shops, commercial garages, and practically all home model-making workshops have no shaper. A great deal of work, therefore, has to be filed to shape. With this attachment such labor becomes unnecessary, and if reasonable care is taken in laying out the work, much that is usually done with a large shaper can be accomplished equally well, if not so rapidly, with this machine.

The design has been carefully studied from different angles and is believed to be practically and mechanically well suited for giving the best results under the necessary limitations of range and power. The dimensions shown on the detail drawing are for a shaper attachment suitable for use on a lathe with a swing of from 9 to 13 in. In machine shops where larger lathes are used, the attachment can be made heavier all around; in fact, it can be adapted for use on faceplates ranging in size from 3 to 5 ft. or even more.



The attachment as mounted on faceplate for planing. For shaping operations it is fastened to toolpost slide by means of tongue on bottom of frame (1), and two bolts, the work being held by faceplate, chuck, or special table on lathe ways

The movement of the table or platen when mounted as shown in the accompanying illustration and the movement of the shaper head when similarly held on the toolrest, is obtained by turning the handwheel that operates the lathe carriage. The length of the stroke can be regulated by stops on the lathe ways. If desired, the lead screw can be utilized for performing the work automatically, but this is by no means necessary.

The parts of the shaper do not require any lengthy description, as their shapes and sizes are fully covered in the detail drawings. It is merely necessary to follow the drawings exactly. Care must be taken that all the parts are absolutely square and true, and the fit of all parts, particularly the slides, are perfectly in line. The slots should be scraped after they have been planed, and care should be taken that the angles match each other.

The tongue on the bottom of the frame, marked No. 1, is planed to fit exactly, without the least shake, in the toolpost slide, and is held in position with two bolts. A special slide can be made, if the builder so desires, but it will be found that with a perfect fit in the toolpost slide, this construction will be rigid enough to stand up under all the shaping operations within the range of the machine.

By taking out the toolpost, part No. 7, and putting in its place a small extension tool holder, keyways in flywheels, pulleys, gears, and cams, as well as oil grooves in bearings and bushings, can be cut on short notice after the holes have been bored and reamed. This can be done before the work has been removed from its position in the chuck or on the faceplate. In the same way it is possible to machine corners that would be difficult or impossible to reach with the ordinary shaper tool.

If a small tool holder is used in the regular toolpost, a large number of tools of various shapes can be made from 3/16-in. square self-hardening steel. Taps, reamers, and counterbores can be held in the chuck by the shank and the flutes formed by shaping, the back gear being used for an index. This is a practical method and will be found a great saver of time.

For use with the shaper head when held on the toolrest a table should be made about

(*Continued on page 82*)

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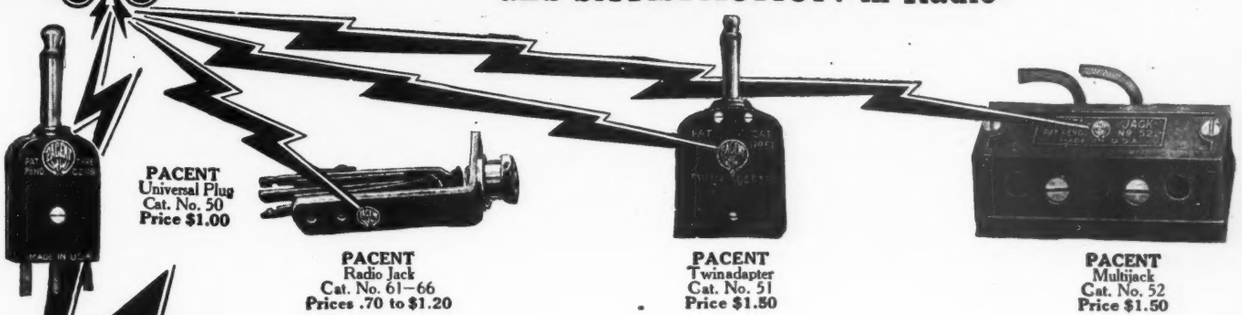

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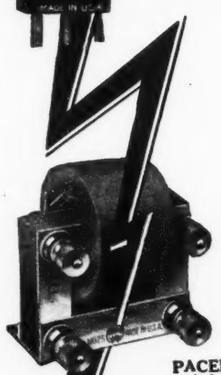
PACENT Radio Jack Cat. No. 61—66 Prices .70 to $1.20

PACENT Twinadapter Cat. No. 51 Price $1.50

PACENT Multijack Cat. No. 52 Price $1.50



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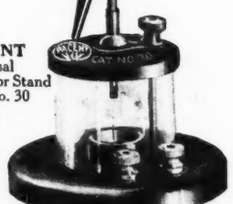

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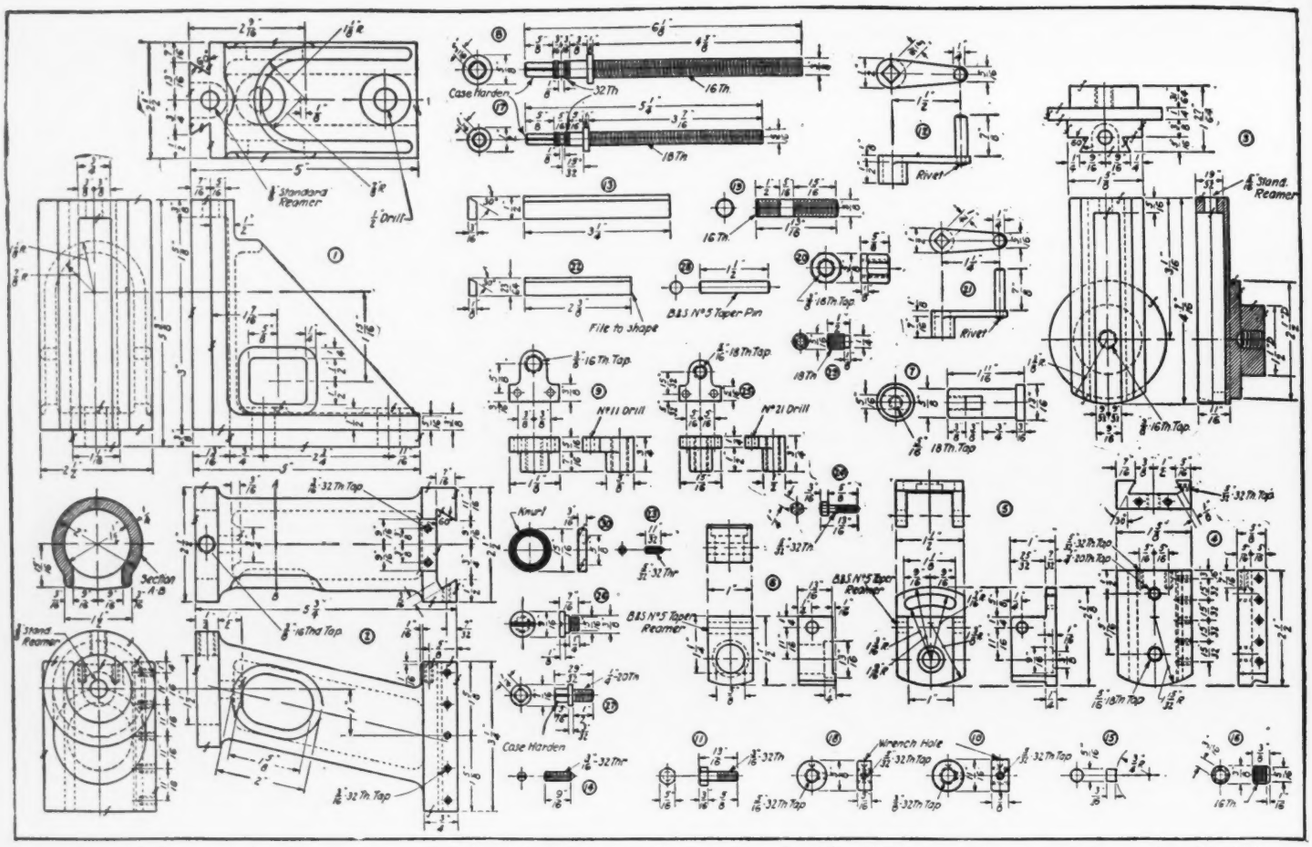


Details of the various parts, the identifying numbers, names, and materials of which are as follows:

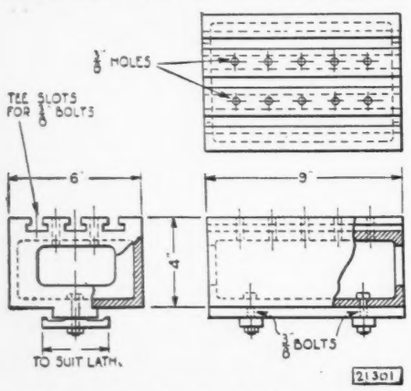
1 Frame - - - - - - C.I.	12 Frameslidescrewhandle M.S.	21 Ram slide screw handle M.S.
2 Ram - - - - - - C.I.	13 Ram gib - - - - - C.R.S.	22 Swivel gib - - - - C.R.S.
3 Swivel - - - - - - C.I.	14 Ram gib setscrews (5 required) - - - Std.	23 Swivel gib setscrews (5 required) - - - Std.
4 Swivel slide - - - - M.S.	15 Ram setscrew thrust block - - - - - - M.S.	24 Ram slide screw nut bolts (2 required) - - - Std.
5 Clapper box - - - - M.S.	16 Ram setscrew - - - M.S.	25 Ram slide screw nut - Bz.
6 Clapper - - - - - - M.S.	17 Ram slide screw - - M.S.	26 Clapperboxswivelscrew M.S.
7 Toolpost - - - - - M.S.	18 Ram slide screw collar M.S.	27 Clapper box bolt - - Std.
8 Frame slide screw - - M.S.	19 Swivel retaining stud - M.S.	28 B. & S. taper pin - - Std.
9 Frame slide screw nut - Bz.	20 Swivel retaining stud nut - - - - - - M.S.	29 Toolpost setscrew - - M.S.
10 Frame slide screw collar M.S.		30 Toolpost collar - - - M.S.
11 Frame slide screw nut bolt (2 required) - - - - Std.		

Shaper and Planer Attachment

(*Continued from page 80*)

6 by 9 in., as shown. On the bottom of the table a tongue is planed to fit the gap between the ways, less 3/8 in. This 3/8-in. space is to provide for a gib to take up all the play by means of setscrews in the inside edge of the tongue. The table is held in position between the headstock and carriage by means of two studs and straps that fit under the gap. All the planing on the table can be done with the shaper itself when the table is set up in position.

The bottom of the table must be planed first and the gib placed in position; the holes for the setscrews drilled and tapped, and the holes in the bottom of the tongue drilled and tapped, and the studs and straps made. When the table is put into place, the gib is set up by means of the setscrews



This special table for holding work is fastened on the bed of the lathe

and the straps tightened by means of nuts on the studs. The table is then rough-planed with a round-nose tool and a light cut is taken; the finishing is then done with a flat-nose tool and about a half turn of the screw, making what is known as a ribbon finish. The slots should be planed very smooth and tested with a size block so that they will be uniform in width, in order that a fixture made for one will fit in the others.

Also plane down on one side so that a try square can be used to square up work, as on a planer platen.

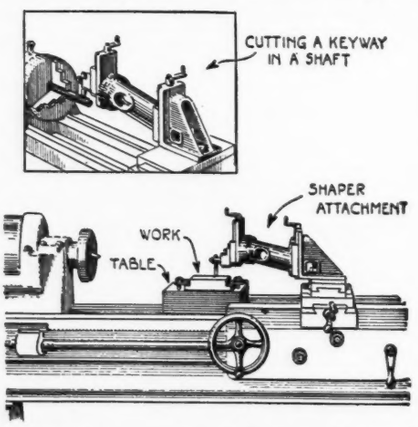
Angle plates, a small vise, a straight edge, and a small set of index centers can also be provided. The height of the table is determined by the swing of the lathe.

When the shaper is strapped to the faceplate of the lathe, a table 5 in. wide and 8 in. long can be made to fit on the carriage slide. This table also should be furnished with T slots. In its manner of working it acts as a small planer platen, so that pieces up to 8 in. in length can be planed on it with ease. A small pair of index centers can be made to fit the table with a swing to about 3 in. and gears can then be cut. By such methods, the full usefulness of the tool can more readily be realized.

It is important that this table for the carriage slide should be planed smooth and true. Before starting to plane it, put a round pointed tool in the shaper toolpost and bring the point of the tool so that a piece of newspaper will be held just between the point and the top of the tool slide.

Run the slide over and see if there is any change between the paper and point of the tool on the other side. If there is, throw out the back gears and shift a tooth or two, relocking the gears and repeating the test; do this until both sides prove alike. Then place the table in position and plane off the top. See that all four corners, when finished, measure alike with the micrometer.

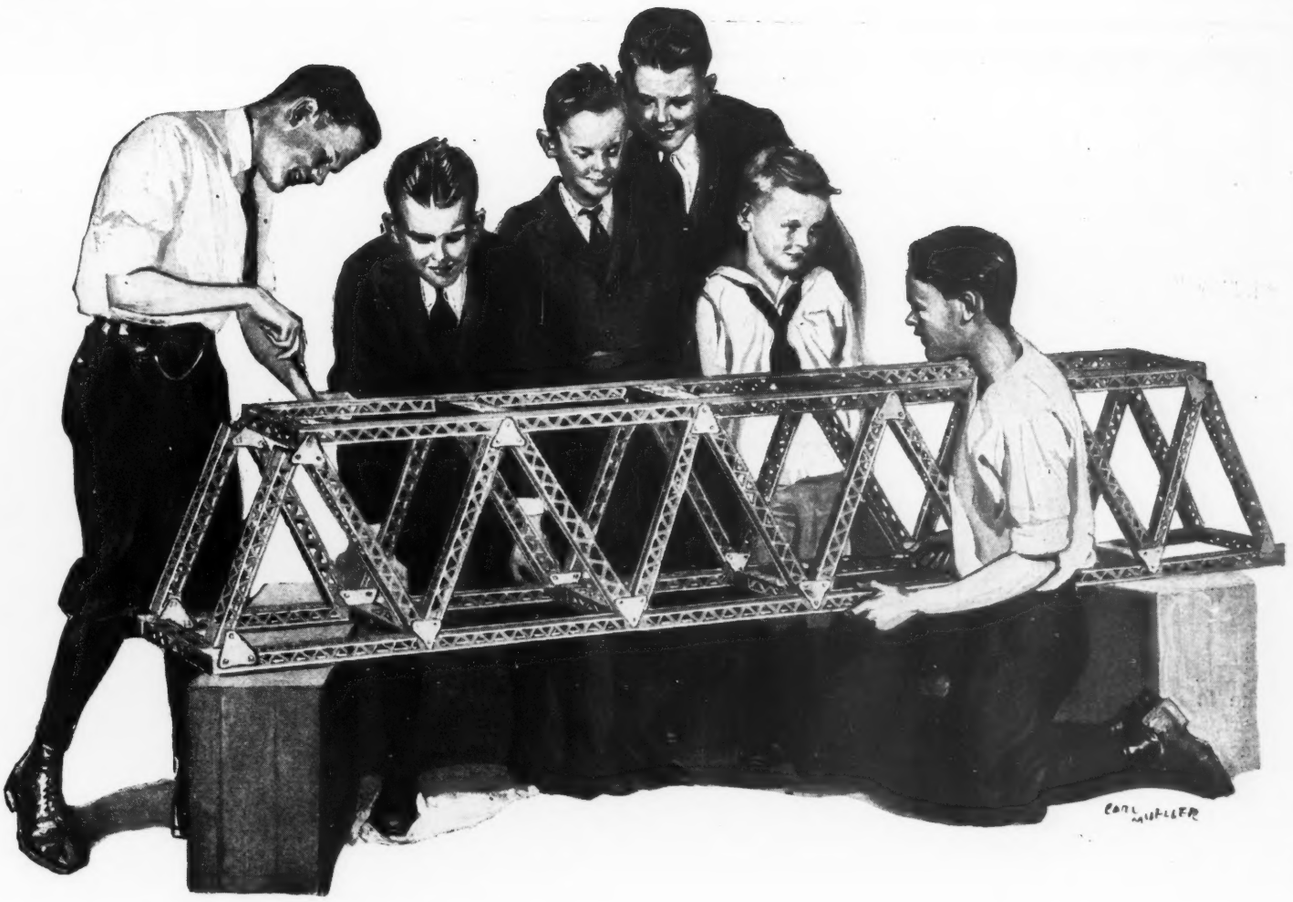
Next, mark the teeth in the back gear, and drill and ream right through the faceplate into the headstock for a tapered dowel pin, fitted with a nut, so that it can be removed readily when not needed. If possible, use this faceplate and angle plate only for the shaper attachment.



Used in connection with the toolrest, the attachment has wide range of utility

To save time in setting up the shaper attachment on the faceplate, it is advisable to drill and ream the faceplate and angle

(*Continued on page 84*)



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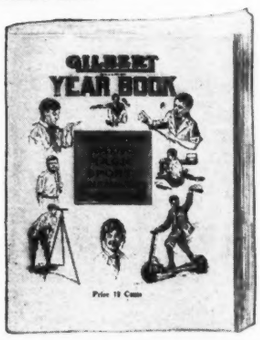

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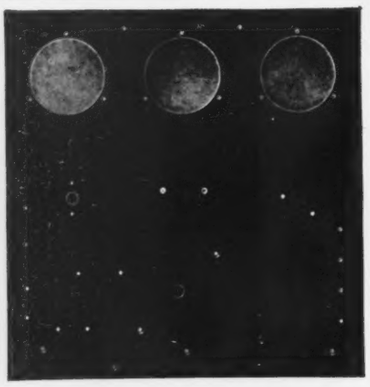

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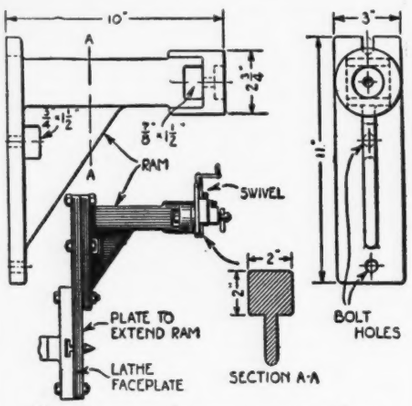
BETTER SHOP METHODS

Shaper and Planer Attachment

(Continued from page 82)

plate for two No. 1 taper pins, also provided with nuts with which they can be withdrawn. It will then always be possible to locate the angle plate readily when resetting it.

To avoid the necessity for the special patterns and core boxes required in making the castings, an alternative design for the ram is given. For machine shops or tool rooms where no facilities are available for



How ram may be constructed without castings, one slide only being used

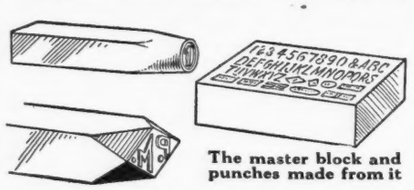
having the castings made easily, this construction, making use of machine steel, is recommended. It has one other point in its favor in that the steel will not crystallize as castings are apt to do, and will stand up better under excessive strains or abuse.

Additional range for the tool can be obtained by means of an extra plate bolted to the faceplate, as shown.

Another simplification that can be made at the option of the builder is to have only one slide on the ram. This does not reduce the capacity and flexibility of the attachment very much, but eliminates a lot of work in making it.

How to Reproduce a Steel Stamp or Numbering Stencil

HARDENED steel numerals or stencils, such as are used for marking metal parts, can be preserved in die form so that duplicate punches can readily be made in case of the breakage or loss of the original. The figure, letter, or mark is embedded in the surface of a block of tool steel that previously has been annealed. As many sten-



The master block and punches made from it

cil marks are made in this block as it is desired to keep. The block is then hardened or tempered.

At any time it is desired to make duplicates, a suitable piece of bar stock or other steel for the stencil, is driven, when soft, into the proper depression in the block. This makes a clean profile and only a small amount of relief work is required to finish the stamp, after which it is tempered in the usual way.—M. B. K.

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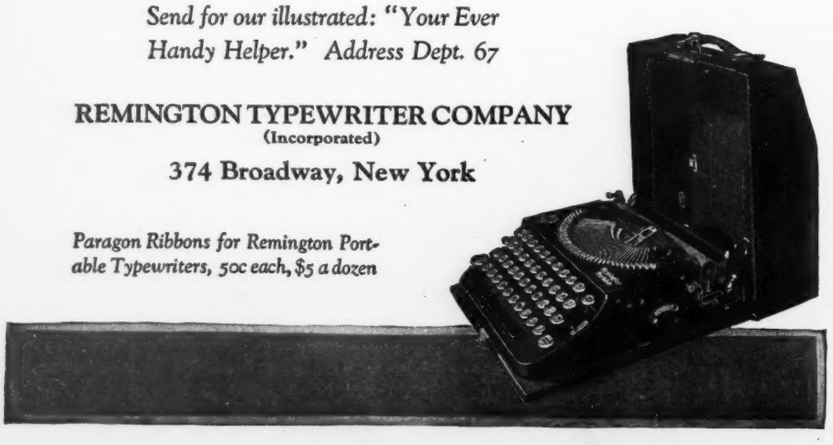


BETTER SHOP METHODS

Keeping Up to the Minute on Shop Methods

WHILE going through a large industrial plant I was deeply interested in the planning department. In it was a young man who, seated at a table before a pile of magazines, was making vigorous use of a pair of scissors, a roll of adhesive paper,

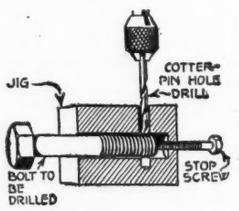
Useful material is marked so as to catch the eye immediately

and a box of wax crayons. While I was watching him, he came to an article in a technical magazine on the pouring of metals, a subject of interest in the foundry department. He clipped a label, marked a red X at the top of it, and stuck it on the page so that it projected at the top of the magazine. This was to call the attention of the foundry superintendent to it. Each department was designated by a different color.

The policy of this firm is that each executive should spend an hour or two a week in the reading room, and all of them appreciate being able to select material of interest to them without taking the time to look through all the magazines.—J.V.R.

Jig for Cotter-Pin Holes Has Adjustable Stop

TO MAKE a jig for drilling cotter-pin holes in screws and bolts, take a block of steel, bore it almost through, and fit a stop screw so that the work can be inserted exactly the right distance.

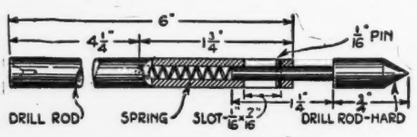


By boring holes of different diameters in one block, the one jig will serve for drilling cotter-pin holes in machine screws and bolts of several standard sizes.—H. F. B.

Making a Center Tester for Tool and Die Work

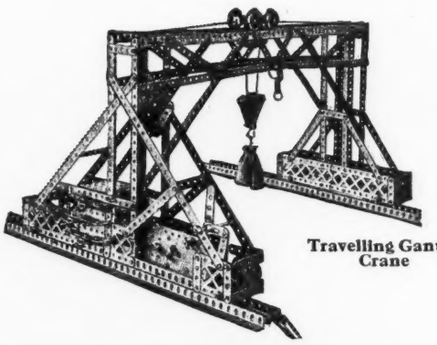
THIS center tester is one I made for myself and use right along on tool and die work in the shop.

The dimensions given may not suit every mechanic, but they can, of course, be

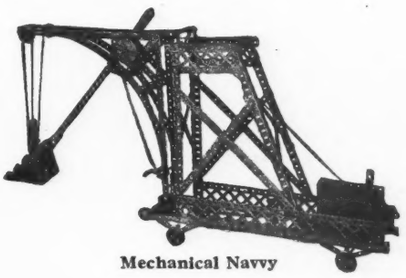


Details of the tester, the dimensions of which may be varied as desired

varied to suit the individual judgment. On fine work an indicator may be used with the tester.—H. BERG.



Travelling Gantry Crane



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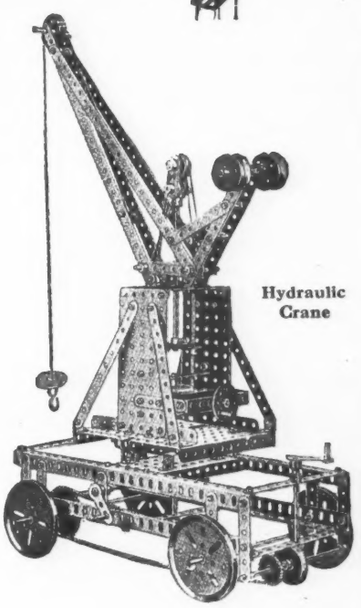

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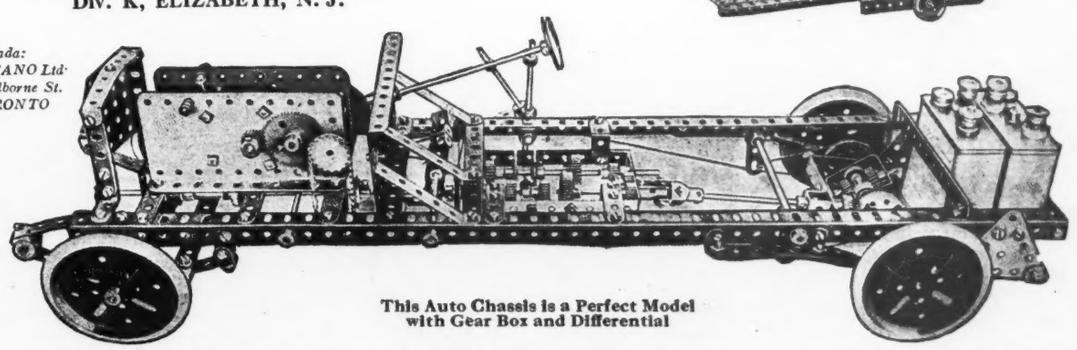

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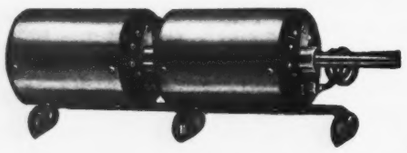

Cotoco Amplifying Transformer for Radio Frequency (Two Stage)

Cotoco Amplifying Transformer for Radio Frequency (Two Stage) Electrically and mechanically correct, as all Cotoco Products are. Can be mounted for two or three stages of amplification. You'll never be satisfied until you are getting the better results secured only through Radio Frequency Amplification with Cotoco tapped transformers.

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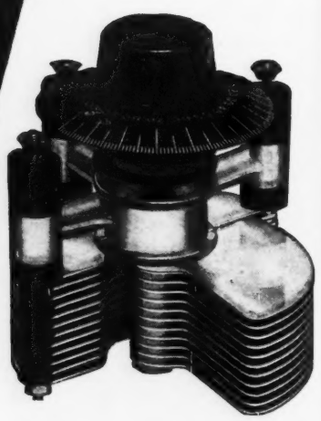

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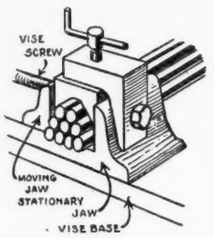
BETTER SHOP METHODS

Holding Nine Pieces Instead of One in Hacksaw Vise

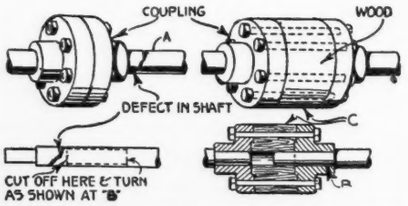
WE HAD considerable 1 15/16-in. cold rolled steel bars to saw into lengths on the power hacksaw, and in the beginning put only one piece at a time in the machine vise. This meant we were almost continuously opening and closing the vise and had to keep a man on this job alone.



A better plan was quickly devised. We placed nine pieces as shown and made a little block that fitted over the shafts and could slide on them. To the stationary jaw of the vise we screwed a strap that in turn held a screw with a handle, used for locking all nine pieces at one time. This speeded up the work and relieved one man for another job, as he attended to the hacksaw only in his spare time.—J. H. MOORE.

Replacing a Defective Shaft

A SHAFT connected with an ordinary shaft coupling was found to have a fracture, as illustrated at *A*. We had to make a speedy repair in order to keep the machinery running, so we removed one



Oak filler block used between coupling flanges

half of the coupling and cut off the defective part of the shaft.

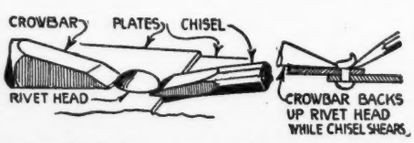
Then we turned down the end of the good shaft, as shown at *B*, and cut a round piece of good, tough oak to the shape shown at *C*.

This was placed over the turned-down end of the shaft with the half coupling.

Bolting the coupling together, we were ready to start the machinery again, for the oak block was the right size to make up for the length of shafting cut off. The view at *C* shows the shaft assembled.—H. J.

Chiseling Off Rivet Heads

TO PREVENT elongating rivet holes in thin metal plates when rivets are removed, it is well to back up each rivet with a crowbar while it is being cut off with a



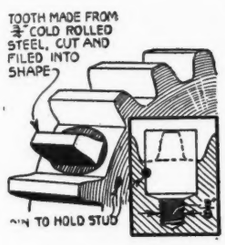
A method that prevents distortion of holes

cold chisel. The crowbar relieves the pressure of the rivets against the plates, and there is then no necessity for redrilling the holes when the plates are reassembled. If necessary, grind the point of the crowbar so that it will hold without slipping at the base of the rivet head.—G. L.

BETTER SHOP METHODS

Key Pins New Teeth in Place on Broken Gear

IN THIS method of repairing broken teeth in a gear or on the rim of an automobile flywheel, a stud made of cold rolled steel is first inserted, as shown. The diameter of the head of the stud should be nearly the width of the other teeth. The threaded end should be about one half that diameter.



The flywheel is then drilled, counter-bored, and tapped to suit the stud, which is screwed in place and locked by means of a pin driven into a hole that is half in the rim and half in the stud. The face and flank of the teeth are then roughed out with a hacksaw and finished by filing. A template of tin can be cut out to fit one of the other teeth exactly and then used as a guide in perfecting the shape of the new tooth.

This repair is particularly useful in replacing one or more teeth on the starting gear of an auto engine flywheel.—J. H. T.

Filing Awkward Shaped Pieces

HAVE you ever tried to file an awkward shaped piece or part that came almost level with the top of the vise? If you have, then, no doubt, you bruised your knuckles

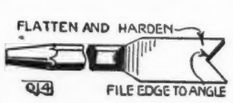
This handle saves knuckles from being bruised

just as the writer did until he made the little file holder illustrated.

A groove is made to fit snugly over the tang of the file, and the handle, being above the level of the file, allows you to work without danger of bumping your knuckles. This is a stunt worth trying if you have much filing to do.—J. F. H.

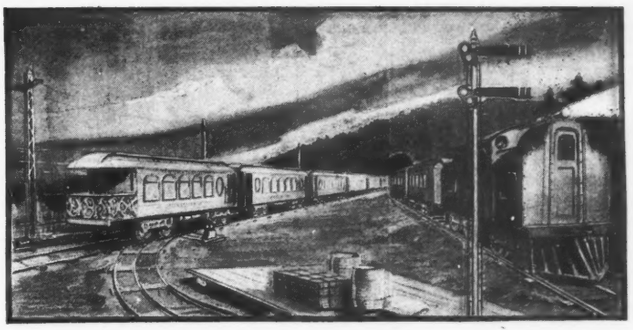
Drilling Cement and Brick

A HANDY tool for drilling holes in brick walls, which the writer has found more effective than the old-fashioned star brick drill, is made by shaping one end of a piece of octagon steel of the desired size and length to a fish-tail bit. Point the other end to fit the chuck of an ordinary brace, and then temper the tool.



Instrument men will find this a help in plugging brick walls for mounting telephones, or drilling through walls when laying cables.—EVERETT IDLOR.

NEW files should be reserved for finishing the larger surfaces of cast iron, bronze, or brass. When the file has worn somewhat, it can be used upon the narrow surfaces of these metals and upon wrought iron and soft steel. A used file is better than a new one for the latter class of work, because it is not so apt to tear the surface.—H. L. D.



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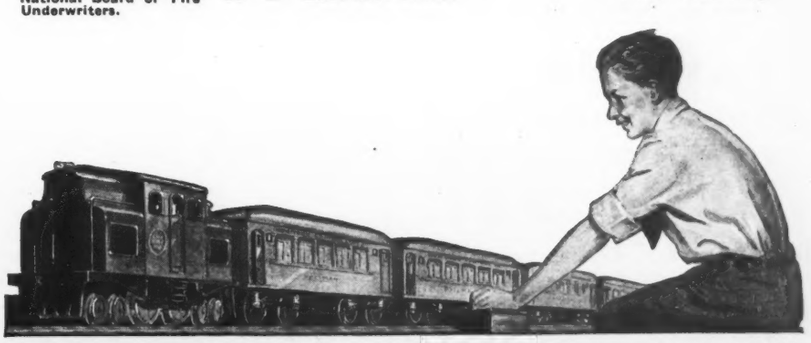

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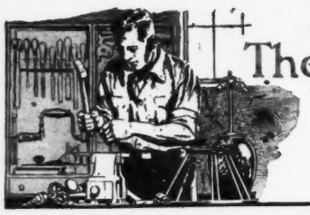
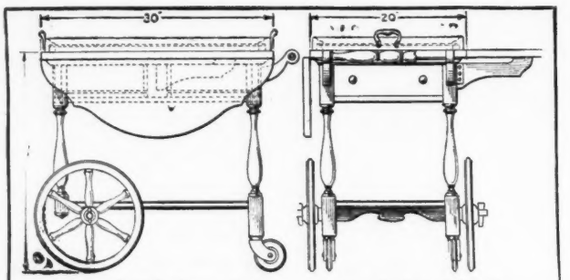


The Home Workshop

Make a Tea Wagon at Half Store Prices

(*Continued from page 78*)

relieve the otherwise straight lines. A plain top is screwed on from underneath and the usual wheels and casters are added. Two tray handles are fastened to the top to take the place of a larger wooden handle. The completed wagon is painted or enameled in cream, light green, or some other appropriate light color, and stenciled ornaments are applied at the corners, and, if desired, at the center and along the upper rails. This design harmonizes well with some of the more modern painted dining-room furniture.



Side and end views of the tea wagon designed by the Home Workshop Department. The full size details and the bill of materials are contained in Blueprint No. 13 of the Home Workshop series

Number 4 is a design with turned legs, having an inclosed shelf directly beneath the top, upon which the tray can be placed when not in use. The tray is a trifle smaller than the top of the tea wagon. The leaves in this case, as in No. 2, are semicircular.

The mahogany tea wagon with a simple inlay on the rails and legs illustrated at No. 5, is unusual because the legs are set on an angle and no casters are provided for the longer ones. The wheels are extra large; they should be 18 in. in diameter, if possible, and very light in construction and design. The tray is a trifle smaller than the table top.

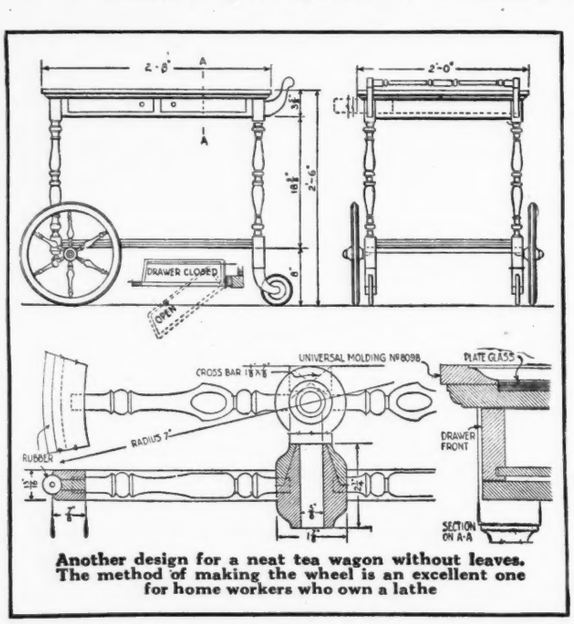
Number 6 is another unusual design, rather ornate in appearance, but not difficult to make, since both the legs and the large wheels are cut out with a band-, jig-, or fret-saw.

The reed tea wagon, shown at 7, is a type now much in favor. It is comparatively inexpensive and not at all difficult to make. A frame 16 in. wide, 24 in. long, and 30 in. high can be made as a foundation for the reed, or one already bored for the binding can be purchased from dealers in basketry supplies. Besides the wooden frame, the supplies necessary are 1 lb. of No. 4 reed for braiding the edges of the frame and ½ lb. of No. 3 reed for weaving the tray base, as well as glass for the tray, and if desired, for the lower shelf.

Another simple type of tea wagon without leaves or turned legs is shown in No. 8. The omission of the leaves makes it possible to provide a roomy silver drawer. In tea wagons with leaves a small drawer is often provided, and sometimes there is a drawer in both ends. The tray handles in this case are made of wood in a style much favored by some furniture designers and craftsmen.

Number 10 is an electrified tea wagon, fitted with a double outlet for attaching an electric coffee urn, chafing dish, toaster, or stove. A length of lampcord plugged in underneath the tea wagon runs to a baseboard outlet or the nearest available light socket.

The majority of tea wagons have turned legs and these and any other turnings required, such as handles, can readily be obtained by any one who has access to a lathe or cares to go to the moderate expense of having the work done by a wood-turner. If you have your own lathe, you can make even the wheels, which provide a particularly interesting problem in wood turning.



Another design for a neat tea wagon without leaves. The method of making the wheel is an excellent one for home workers who own a lathe

In place of special turnings, stair balusters can be used. If they are old fashioned ones, they may have more or less individuality in design and serve fairly well as legs, but modern mill-made balusters are often spindly and inappropriate for furniture.

The legs do not, however, have to be

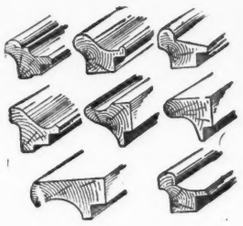
THE HOME WORKSHOP

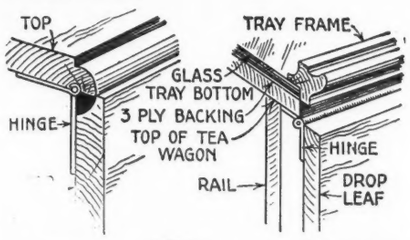
How to Make a Tea Wagon

(*Continued from page 90*)

turned. They can be plain and straight, or have the edges slightly rounded or chamfered, or they can be made with decorative edges and "voids" in fret-saw fashion.

Tea wagon wheels can be purchased from dealers in manual training supplies and from some stores handling baby carriage wheels; furniture stores often will obtain them on order. A wheel that is regarded more or less as standard is 16 in. in diameter with a ⅜-in. rubber tire. The spokes are





Tray molding, handles, and other tea wagon details

turned as shown and have ornamental flats. The axles are usually about 17½ in. between the hubs, but they can be cut in half and attached separately to accommodate the wider wagons. These wheels are usually made in mahogany, oak, or gum, the latter taking a good imitation mahogany finish. Baby carriage wheels can, of course, be substituted.

Casters can be obtained without difficulty. They usually have rubber tired wheels 3 in. in diameter and about ½ in.

(*Continued on page 92*)

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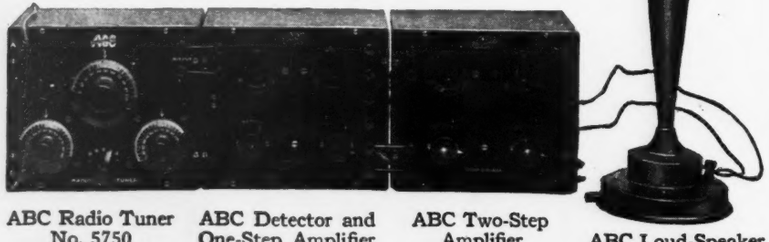


ABC Radio Tuner No. 5750 | ABC Detector and One-Step Amplifier No. 5013 | ABC Two-Step Amplifier No. 5014 | ABC Loud-Speaker No. 5500

"Best Ideas" of Readers Win Home Workshop Prizes

A FIRST prize of $15 and a second prize of $10 are awarded each month for the best ideas published in the Home Workshop Department. These prizes are given in addition to the regular rates paid for contributions and are, therefore, a bonus for especially good suggestions.

Any ideas that have helped you in your own home workshop or aided you in repairing or improving your home are apt to be of value to other tool users and are possibly prize-winning material. If you will describe them briefly and send them to the Home Workshop Editor, POPULAR SCIENCE MONTHLY, 225 West 39th Street, New York, they may deserve one of the awards.

The articles should be accompanied either by photographs or pencil sketches to make clear the details of construction.

The prizes for November have been awarded as follows:

FIRST PRIZE, $15: **Paul H. Byer,** Hagerstown, Md., for a description and the working details of an automatic heat regulator (see page 103).

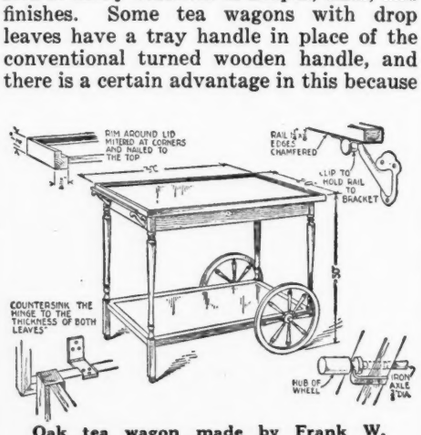
SECOND PRIZE, $10: **John A. Mahon,** Baltimore, Md., "Auto and Phonograph Horns Combined to Make Loud Speaker" (see page 122).

How to Make a Tea Wagon

(*Continued from page 91*)

thick. Some are solid and others have small spokes. Ordinary casters will serve the purpose, but are not as neat.

Although wooden handles are frequently used on the trays, metal tray handles are sold in many varieties of shapes, sizes, and finishes. Some tea wagons with drop leaves have a tray handle in place of the conventional turned wooden handle, and there is a certain advantage in this because


RIM AROUND LID MITERED AT CORNERS AND NAILED TO THE TOP
RAIL IS ¾" EDGE CHAMFERED
CLIP TO HOLD RAIL TO BRACKET
COUNTERSINK THE HINGE TO THE THICKNESS OF BOTH LEAVES
RUB OF WHEEL
IRON AXLE DIA

Oak tea wagon made by Frank W. Shultis, of Lansing, Mich. Top, which is hinged, covers silver compartment. Table leaf hinges with extra holes are used so that top will stand open. Handle is supported by brass hand-rail brackets

the smaller tray handle is not so much in the way when the tea wagon is being used as a luncheon table. A craftsmanlike way of providing handles is to make them of hammered brass or copper.

The regular large wooden handle can be disposed of when the wagon is used as a table if some simple arrangement is made to swing it below the end rail.

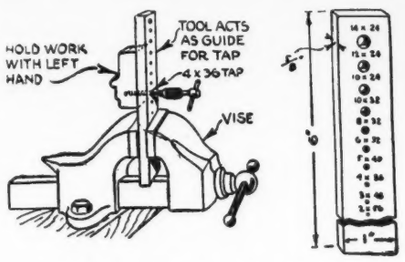
Tray moldings are made in a wide variety of styles and can be obtained easily.

THE HOME WORKSHOP

Drill Block Prevents Breakage of Small Hand Taps

TO TAP a small hole in a piece of metal held in a vise without breaking the tap or cutting the thread out of square requires much skill and care. When the tap reaches the bottom of the hole, the resistance is hardly felt and yet the smallest fraction of a turn often breaks the tap.

This difficulty can be eliminated if a piece of cold rolled steel 5/8 or 1/2 by 1 by 6

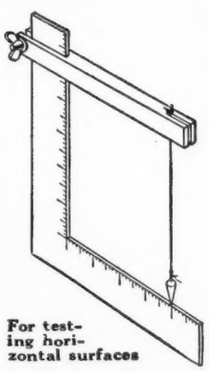


The tap guide and how it is used

in. has a number of holes drilled through it to suit the different sizes of taps ordinarily used. The piece is held vertically in the vise and the tap is placed in the proper hole. The work to be tapped is held in the left hand against the flat side of the fixture and tapped in the usual way. It will be tapped perfectly true and as soon as the tap reaches the bottom of the hole the strain will be felt before there is any danger of the tap's breaking.—ARTHUR E. SCHOLZ.

Steel Square and Plumb Bob Form Serviceable Level

A SERVICEABLE and unbreakable level can be made with a steel square, a plumb bob, and a piece of hardwood. Saw a long notch in one end of the stick and a short notch in the other end and bore a hole through at the long notch. Insert a bolt with a wingnut to clamp the bar to the square, as shown. The device can then be used in place of a spirit level on horizontal surfaces by observing the deflection of the plumb bob in relation to the scale.—J. G.

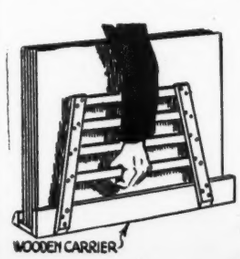


For testing horizontal surfaces

Carrying Large Sheets of Glass, Veneer, or Cardboard

TO CARRY sheets of glass, veneer, cardboard, and other flat, unwieldy objects, make a light-weight wooden rack as shown. A series of cross pieces afford a choice of hand grips; they make it unnecessary to strain the arm down to the bottom of the sheets.

Strips of felt may be glued to the parts of the rack that come in contact with the glass.—C. NYE.



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This marvelous instrument, clearly explained in "The Outline of Science" is the source of much of our present knowledge of the universe

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Come out of the humdrum of daily life into a marvelous new world—where you can lift your eyes and read the story of the heavens, see into the depths of earth and ocean, view the activities of invisible life, look back to the dawn of mind, watch man as he overcomes the thrilling mysteries of life and time and space.

Here, truly, is the most amazing story ever written—for it reveals to you truths of what man has accomplished that go beyond the wildest flights of imagination; it takes you into the startling realms of science and shows you simply and clearly the marvels that have heretofore been so vague and mysterious.

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Edited by J. Arthur Thomson, Professor in the University of Aberdeen, Scotland

covers in one flowing, non-technical story all scientific achievement since the world began. You read the absorbing history of Evolution in the Light of Today—The Ascent of Man—How Darwinism Stands Today—The Romance of the Heavens—Other Worlds than Ours—The Moon—The Sun—Evolution of the Stars—Life on Mars—Sun Spots and Magnetic Storms on Earth—The New Knowledge: Wonders of the Atom—The Discovery of the Electron, the Wonderful Thing Which Has Revolutionized Our Ideas—The X-Ray—Radium and Its Wonders—The Marvels and Mystery of Electricity—Wonderful Instincts, Devices, and Adaptations of Animals and Birds—Animal Mimicry, Camouflage and Migration—Animal Intelligence—The Dawn of Mind—The Life of Bees, Ants and Other Insects—The Human Body—New Discoveries—The Plant World and Its Marvels—The Wonders of Deep Seas, of Seashores, and of Rivers—The Story of the Rocks—Biology and the Beginning of Life—All About Bacteria—Marvels of the Invisible World—Wireless Telegraphy—Wonderful Scientific Instruments—The Mind of Man and the New Psychology—Psychic Research—and all the other almost unbelievable discoveries man has made. Small wonder that this work has been hailed as the greatest publishing event in many years and is being eagerly read by scores of thousands.

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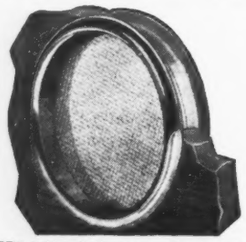
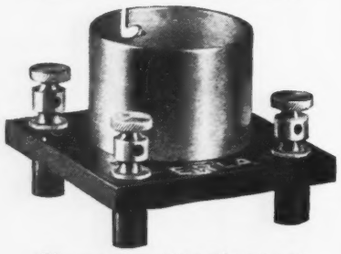
ERLA products lead radio development, do not merely follow it. Their efficiency and exquisite finish are giving them preference everywhere. For maximum results and permanent good looks, insist on ERLA products.

Voice and music a thousand miles distant are heard perfectly through loud speaker with only one ERLA radio frequency transformer. Its efficiency is unequalled. Made in 3 types. Each.....$6.00



ERLA Bezels improve the appearance of any receiving set 100%. They are beautifully made of heavily nickeled brass. Telescoping rim gives perfect fit of 1⅛" hole in ⅛" to ¼" panels. Each.....20c



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Electrical Research Laboratories
Dept. G 2515 Michigan Ave., Chicago

Aerial Yachtsmen

(*Continued from page 27*)

The longer the duration of the gust, the better.

During the period of increasing wind velocity, a pilot should turn his sailplane head on to the wind and should steadily gain height. In the second period, he should turn at right angles to the wind (the machine usually loses some height during this period). At the beginning of the third period—of decreasing wind speed—the machine should be turned tail to the wind. Since its speed is relatively greater than that of the wind at diminishing velocity, it is possible for the machine to gain height. During the period of minimum speed the pilot should again turn at right angles to the wind.

Compare this thrilling method of flight, in which the air offers a constant challenge to the pilot's ingenuity and resourcefulness, and in which he must depend for his motive power solely on his skill in "outguessing the winds" with the power plane flights in the recent Pulitzer contests at Detroit, Mich., in which the pilots, by merely watching dials and pulling levers, had instant command over power, speed, and direction. Such a comparison reveals the challenging nature of the fascinating new sport of air sailing.

Qualities an Air Pilot Needs

The most necessary qualities for a pilot in soaring flight are knowledge of the structure of the wing and ability to recognize in advance the nature of gusts. This quality might be called "seeing the air." Some airplane pilots fight the air; others ride it. The pilot of the plane in which I flew as passenger from New York to Omaha in October, 1921, used the air gusts to gain altitude and would catch the gusts under the wings and let them buoy up the machine for several hundred feet at a time. He followed the trends of wind instead of fighting them as some fliers do. A motor machine flies best in still air or with favoring winds; a sailplane must have gusty and strong winds, and its pilot must "feel" what to do with them, just ahead of time.

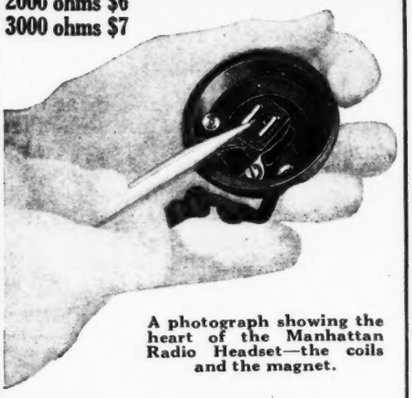
A gust of wind is in reality a wave of air. If you learn how to keep your sailplane In the front side of a high wave, you will glide downhill for miles, just as a canoe with a wave at its stern will be carried along a river. But waves of air are not always what they seem. Sometimes, while there is a blanket of still air just over the earth's surface, swift air currents move above the calm. I have been in a balloon the bag of which was being carried along by one of these upper currents so swiftly that from the car beneath it seemed as if a strong wind were blowing against our faces, yet in reality the car was moving in the layer of still air.

How the Birds Do It

Experiments show that birds seem to "feel" their way through the air and to sense strength and direction of the wind. This may lead to the invention of sensitive anemometers combined with wind vanes, mounted on antennae, or of "feelers" projecting far in front of the sailplane of the future, to warn the pilot of the direction and relative strength of wind gusts.

Although the pilot is all important in air sailing, the machine, of course, must be very responsive to control, with sensitive rudders, elevators, and ailerons.

2000 ohms $6
3000 ohms $7



A photograph showing the heart of the Manhattan Radio Headset—the coils and the magnet.

It's What's Inside the Receiver Case that Counts

Remove the cover of a Manhattan Radio Headset. Note the large horse-shoe magnet. It is made of Tungsten Steel—the most expensive material for permanent magnets, and the best because of its hardness and property of retaining magnetism indefinitely.

In the center of the case is the electro-magnet with its pole pieces made of Silicon Steel. Energy received from a wireless message is exerted on the diaphragm through the pole pieces. If the pole pieces absorb any of this energy, the pull on the diaphragm is less and the performance of the Headset weakened. Silicon Steel pole pieces cut down energy loss, and give strong signals.

These are two points in the interior construction of Manhattan Headsets which make for superiority.

Look for the Manhattan Headset box on your radio dealer's shelf. It's illustrated below. All genuine Manhattan Radio Headsets may be identified by the "M" Seal Flash on the back of each receiver case. It's your guarantee of quality.

MANHATTAN
ELECTRICAL SUPPLY CO., INC.
Makers of the Famous Red Seal Dry Batteries and Manhattan Head Sets

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ST. LOUIS 1106 Pine St.
SAN FRANCISCO 604 Mission St.

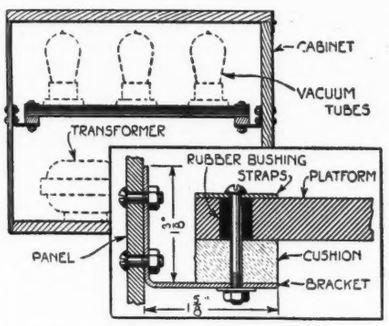
Next month we will tell you more about the "heart of the Manhattan Headset."

THE HOME WORKSHOP

Brackets Support Vacuum Tube Platform in Radio Cabinet

A NEAT and inexpensive method of mounting a platform for vacuum tubes in a radio cabinet is to support it from brackets on the panel and the back of the cabinet, as illustrated. This has an advantage over the usual U-shaped support because of the ease with which soldered connections may be made between rheostats and other parts below the platform that often are difficult to get at.

With this design the entire under side of the platform is free and it may be adjusted



This mounting leaves space clear under tube platform and makes it easier to solder connections

to any height to suit the transformers used, if they are to be placed in the usual position under the tubes. Cushions of soft rubber are placed between the brackets and the platform, which is insulated entirely from the retaining screws by means of rubber bushings and straps made of fiber, hard rubber, or composition.

When the mounting has been prepared, the platform can be removed while the vacuum tube sockets are fixed to it, and then the whole replaced as a unit. If the transformers are attached to the under side of it, the soldering of the connections between tubes and transformers also can be done before finally fastening the platform in place.—CHARLES F. LANOUETTE.

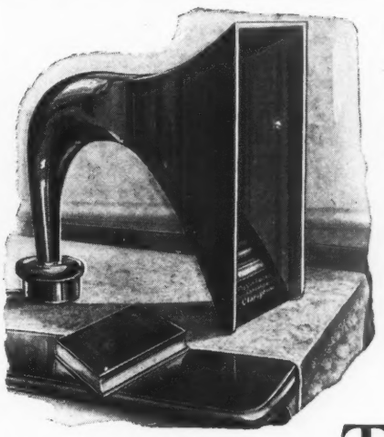
Nail Forms Handle for Cork

CORKS in varnish cans and other containers often fit flush and are very difficult to remove. This is particularly annoying when small quantities of the liquid contained in the can are required at frequent intervals.

One of the simplest methods of providing a handle for the drawing of such corks is to drive a wire nail through the cork from the under side and bend the point at an angle to give a finger grip.—J. M. PIPP.

Removing Rust from Nickel Plate

RUST spots on nickel surfaces may be removed by rubbing the parts thoroughly with hard oil or vaseline. Allow oil to remain for several days if possible; then wipe clean with a cloth soaked in ammonia. If the spots do not yield to this treatment, add several drops of hydrochloric acid to the ammonia. After applying the solution, dry at once, then rinse with water, dry again, and polish.—DALE R. VAN HORN.



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The Master-Baldwin "Throatype" Clarophone, complete - - - **$22.50**
Described below.

The Master-Baldwin Head Phone - - - - - - - - - **$ 9.00**
The new and improved Baldwin Phone. Is sufficient for all except code work. One does the work of two ordinary phones.

The Baldwin Head-Set - - - **$16.00**
The standard supersensitive head-set for those who want the double phone.

This Amazing Radio Feature

means radio enjoyment for the entire family at a price within the reach of all

YOU who know radio equipment know the Baldwin Phone. You know its war record.

The Government commandeered the Baldwin factory during the war to assure Baldwin Head-Sets for War Vessels and Army and Government Stations.

Where exacting work is done there you find Baldwins.

Now this amazing phone is available to the public in the *Master*-Baldwin *"Throatype"* Clarophone, the newest and most perfect speaker.

A *Clear*speaker

The *Master*-Baldwin is not a so-called "loud" but rather a *clear*speaker, which enables a roomful of people to hear every word or note.

—hear perfectly every sound, every overtone, even the harmonics. No rasping, buzzing, breaking or any noises save those caused by your receiving set.

—hear clearly and distinctly throughout the average size room any broadcasting that your set will pick up.

No changing of a head-set from one to another. No one misses part of the program.

Now you can really enjoy radio with the *Master*-Baldwin *"Throatype"* Clarophone.

Two Secrets of Its Perfection

One secret of this instrument is a marvelous mica disk, unaffected by heat, cold or electric currents, which is actuated in both directions by an armature tone-arm superimposed in a magnetic field.

The other is a specially designed speaker, which follows almost exactly the shape of Caruso's throat.

And its rectangular mouth follows the principle which opera singers know and use to get full resonance from the roof of the mouth.

So the *Master*-Baldwin *"Throatype"* Clarophone follows scientifically a perfect model.

It gives you the best from your receiving set.

$22.50—An Amazing Price

The wonderful Clarophone costs but $22.50, complete. So everyone may have one.

Simplicity of design and large scale production account for this revolutionary price on an instrument which is the highest quality the world affords.

Try It at Our Risk

We make you the judge. Test it 10 days. Attach it to your set. Compare with others. We know you will be delighted.

If not pleased, return it to your dealer and get your money back.

Ask your dealer for the *Master*-Baldwin *"Throatype"* Clarophone.

If he hasn't it order from us, inclosing $22.50. We'll ship your Clarophone immediately, charges prepaid. (Reference: Citizens National Bank, Los Angeles, Calif.)

Know the real joys of radio. Get this necessary equipment at once.

Master Radio Corporation,
Dept. 5011, 631 So. Spring St.,
Los Angeles, California.

The Master-Baldwin "Throatype" Clarophone
PATENT PENDING

Send this if your dealer cannot supply you.

Master Radio Corporation,
Dept. 5011, 631 So. Spring St.,
Los Angeles, California.

Enclosed is $22.50 for one *Master*-Baldwin *"Throatype"* Clarophone, charges prepaid. My money will be refunded if I return the instrument within 10 days to you, in case I am not satisfied.

I buy my radio equipment from

(DEALER'S NAME) .....

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Balances in your hand as naturally as a Colt .45

Here's an "eye-opener" for the man who has always used the old style frame. A well designed, substantially built hack saw frame has a perfect "hang"—takes any length of blade from 8 to 12 inches and can be set to cut in four directions without removing the wing-nut. A constant tension on the bolts holding the blade and a positive adjustment on the tubular back saves cuss words and much valuable time when changing blades. Hard rubber checked handle and stream line design. A Hack Saw Frame you will always swear *by*—never *at*.

Ask for *Starrett Pistol Grip Adjustable Hack Saw Frame No. 169.* You can get it at almost any hardware store.

Write for Catalog No. 22 "W" and the Supplement describing the new Starrett Tools.

THE L. S. STARRETT CO.

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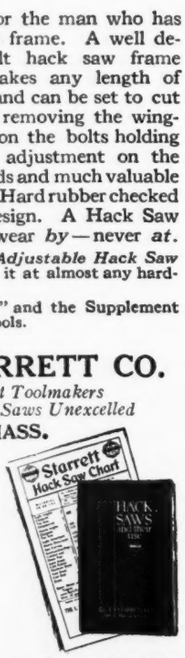
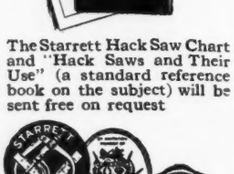
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.



The Starrett Hack Saw Chart and "Hack Saws and Their Use" (a standard reference book on the subject) will be sent free on request



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FAST though the half-back may be, the Bausch & Lomb Tessar gets him on the run, clearly and sharply, not blurred. For speed work the Tessar is unsurpassed. And on cloudy days or indoors, it makes possible snapshots where ordinary lenses require time exposure.

Made by America's greatest optical house, the Bausch & Lomb Tessar is unsurpassed by any other anastigmat lens in the world.

Tessar is the lens for both amateur and professional.

Write for booklet, "What Lens Shall I Buy?" describing our complete line of anastigmat lenses.

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THE HOME WORKSHOP

Antenna, for Use in Towns, Attaches to Clothes Line

RADIO fans who live in upper apartments or flats where old-fashioned pulley clothes lines are used, can install an aerial with very little difficulty. The first step is to obtain a large, empty wooden reel and make a bracket for it, so that it can be fastened to the window or back porch near the clothes line. Fasten an eye and about 6 in. of strong cord or light rope to the reel. Tie an insulator to the end of the cord and

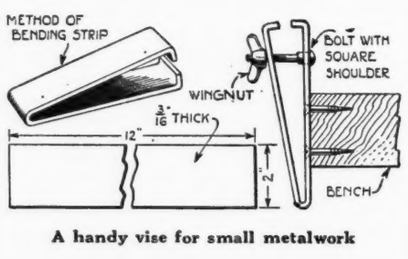
Since this antenna is withdrawn when not in use, there is no lightning hazard nor possibility of static discharges when the set is first connected

connect with the insulator the antenna wire, allowing a short end sufficient to serve as a lead-in.

At the farther end of the aerial wire place another insulator, 6 in. more of cord, and a third insulator, which is to serve as a stop when it comes in contact with the pulley on the clothes-line pole. To erect the aerial, it is merely necessary to attach this last insulator to the clothes line and pull it out as far as it will go. The antenna can be as quickly withdrawn when it is no longer needed.—P. A. DASCHKE.

Light Bench Clamp Useful in Holding Radio Parts

SMALL work on radio apparatus and electrical instruments often can readily be handled in a bench clamp made as shown, from materials to be found in most scrap boxes. The body of the clamp is a piece of flat steel, about 3/16 in. thick, 2 in. wide, and 12 in. long. The ends are bent in to form the jaws and the center of the



A handy vise for small metalwork

strip is turned sharply to bring the ends within 1 in. of each other.

Countersunk holes on one side are provided for the screws with which vise is fastened to bench. A stovebolt passes through holes drilled in the sides of the body opposite each other and a wingnut serves for setting the jaws on the part to be held. The elasticity of the steel opens the jaws when the work is to be removed.—G. A. LUERS.

Germs from Other Worlds

(*Continued from page 41*)

similar to our own has been very lately disputed, as a result of remarkable observations at the observatory on Mount Wilson, Calif., where spectroscopic studies are said to have revealed no trace of water vapor or oxygen around the planet. On the other hand, some observers advance evidence to prove that there are heavy clouds hanging about Venus, and that her temperature is comparable to Earth's.

So the scientific debate stands to-day, and meanwhile, the possibility of radio communication with the other planets—provided there are indeed living beings upon them—has made this whole discussion one of the greatest popular interest, while the discussion itself has aroused an intense renewed interest in the original theory of Arrhenius as to the spread of life spores throughout the universe by light rays.

Space is, according to Arrhenius, filled with shoals of living "seeds," and occasionally spores of bacteria, which settle upon Earth and other planets and commence life in those worlds where conditions are suitable.

Sunlight Composed of Light Corpuscles

This theory is strengthened by the belief that sunlight is composed of minute "light corpuscles"—bits of matter that are being incessantly radiated from the Sun. That side of Earth turned toward the Sun is being continually bombarded by untold billions of these light corpuscles. Though in size extremely minute, yet they are numerous enough to exert a "push" upon our globe, in opposition to solar gravitation, equivalent to 75,000 tons.

Many of the particles of dust occupying interplanetary space are smaller than the light corpuscles in question. These dust particles are, moreover, charged with life germs. When light corpuscles from the Sun hit those dust particles that are smaller than themselves, they push them along through space, and by chance may transport them to earth and other planets.

This force of light, known as light pressure, is powerful enough to detach a living organism from Earth's atmosphere, or that of some other planet, push it out into space, and finally transplant it upon the soil of another world. Twenty days would be required for organisms to traverse the distance separating us from Venus or Mars.

What Arrhenius Believes

Professor Arrhenius considers that while many of the seeds and spores, during their celestial journey, will be killed, occasionally they will retain their vitality and settle upon fertile ground, creating life in worlds that have cooled down sufficiently to form a suitable abode. From this we might infer that all life, from one end of the universe to the other, bears an intimate relationship, and that the higher beings evolved from it and perhaps residing—as some still believe possible—on Venus or Mars, may not, after all, be so greatly dissimilar from ourselves as most imaginary drawings of the "Martians" have pictured them.

If the Sun's light pressure is capable of transplanting tiny life germs from planet to planet, it might more easily transport the spores of bacteria, since they are still smaller. The planet Venus, our sister world, is, Professor Arrhenius thinks, probably a suitable abode for the lower

(*Continued on page 99*)

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1500 GOOD TOOLS

"Accuracy is my family name," says Mr. Punch

Calipers, Steel Rules and Surface Gauges in all the standard styles and sizes.

You've got to buy measuring instruments and precision tools—micrometers, gauges, calipers and steel rules—largely on *faith*. The reputation of the maker is your best guarantee of *accuracy*.

The confidence and faith that mechanics, artisans, and other workmen have in the Goodell-Pratt 1500 Good Tools *is never misplaced*. Before you buy another steel rule, measure it up with a micrometer.

Exceptional accuracy—the result of taking pains

If you could see the infinite pains taken in the making of all Goodell-Pratt 1500 Good Tools—you would realize why so many thousands of workmen have such *faith* and *confidence* in the Goodell-Pratt Tools they use.

Your hardware dealer has Goodell-Pratt Tools or can get them for you. Talk to him. Meantime, write for a copy of our new machinist tool catalog picturing and describing the very tools you have always wanted to call your own. It's free.

GOODELL-PRATT COMPANY

Toolsmiths

Greenfield, Mass.

Surface Gauge No. 55 with Micrometer Adjustment Price, $12.00

They Wouldn't Be The Same

Given the same tools and material, two different workmen would make two kinds of a house. The house of one would be well finished—its interior, decorations and grounds a pleasant sight to behold—the small details given attention—a house well made, finished and complete.

The other would build, but not so cleverly—you know the difference in two people. You would see the amateurishness in his work. His house would not serve as well or last as long as the house of the first builder.

So it is with Machinists' Tools. There is a difference in the way they are made, in the hardening and finishing of the steel, a superiority in design, a higher accuracy, cleaner graduations, here and there a slight advantage, which, all combined, make a superior Machinists' Tool.

BROWN & SHARPE
MACHINISTS' TOOLS

represent the first builder's product. They were the first precision tools in America. Their superiority is shown by their fine finish, clean cut graduations, correct design, their world known accuracy and long life. Send for copy of our No. 28 Catalog, listing 2000 different tools.

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"The Biggest Little Lathe Built"

Accuracy and ***precision***—that's what you expect in lathe work and the only way to have the work done just as you want it is to do it yourself.

The MONARCH Junior Lathe is made especially for small shop or home workrooms. Inventors, experimenters, mechanics and auto repairmen find it to be just the tool they want, for it turns out any small work that other lathes will and does it to 1/1000 of an inch accuracy.

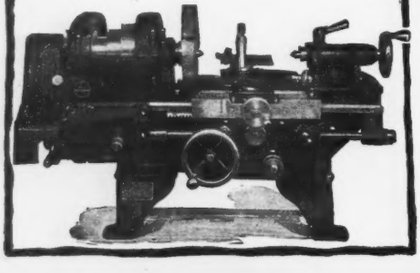
The MONARCH Junior Lathe is small, compact, completely equipped and trouble-proof. Anyone can soon learn to operate it. Beginners can't jam it and expert mechanics prefer it.

Write today for our Free Catalog telling all about the MONARCH Junior Lathe as well as the complete line of MONARCH Lathes which are built up to 30 inches swing.

Monarch Junior Lathe 9 inch Swing — 2½ ft. Bed — **PRICE $225** — Semi-Quick Change Gear and Bench Legs

The Monarch Machine Tool Co.
401 Oak Street, Sidney, Ohio

This lathe is also made in a larger size, with 11 inches swing, at slightly higher price. Full details on request.



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Plant Hunters Risk Lives

(*Continued from page 29*)

lint valued at over $6,000,000 by Arizona and California growers.

These are but a few of the many foreign crops and fruits that have been established in this country through the crop introduction activities of the Department of Agriculture. Prominent among other plant immigrants are: Chinese jujubes, persimmons, edible bamboos, chayotes, Japanese udo, Egyptian and Algerian date palms, Indian mangos, yang mae trees, South and Central American avocados, Chilean strawberries, Colombian blackberries, wild peaches and almonds, wild alfalfas, dwarf almonds, cherries and apricots, fruited currants, Chinese pears, Chinese petsai, dasheens, tung-oil trees and pistachio trees.

In His Country's Service

The early service rendered by the Office of Foreign Plant and Seed Introduction of the United States Department of Agriculture owes much of its success to the enthusiasm of Mr. Barbour Lathrop, of San Francisco. In addition to his individual work in discovering and introducing many foreign plants, nuts, and fruits into this country, Mr. Lathrop, in company with David Fairchild, now chief of the office, traveled at Mr. Lathrop's expense for three years through many countries, collecting new plants and laying the groundwork for future broad and constructive effort.

One of the first of the exploring scientists, Frank N. Meyer, finally lost his life in the service, after passing through experiences that would match the tales of a soldier of fortune. In the nine years spent in China, Siberia, Turkestan and Korea, he walked over 10,000 miles in search of agricultural gems. Alone and miles from help he fought off Chinese ruffians who sought to hinder his work. For from six to eight months he traveled through the wilderness without seeing another white man. During this time he gathered and transmitted to Washington thousands of plants that have enriched the fortunes of many farmers.

His invaluable work was suddenly terminated by his accidental drowning while en route home, but the memory of his achievements is kept fresh in the minds of other workers in the service by the "Frank N. Meyer Medal" awarded annually by the American Genetic Association for the most outstanding achievement in plant introduction work.

Some African Products

Dr. H. L. Shantz, another of the leading agricultural explorers, has invaded the innermost jungles of darkest Africa, on a 9000-mile trip, in many respects the most remarkable ever made by one of Uncle Sam's plant hunters. Personally, he has sent in 1600 specimens of various kinds of African fruits, nuts, sorghums, and other unusual horticultural products.

In Cape Colony Doctor Shantz obtained cuttings of the speckboom, a forage crop that gives evidences of adaptation to culture under Californian conditions; and he collected also many samples of forage and desert plants that thrive under African arid land conditions, and that may be of importance in vegetating our Western ranges. In East Africa he discovered and secured specimens of the famous telfaeria nut tree, which bears large gourds two or three feet long, containing a number of deliciously

(*Continued on page 99*)

Plant Hunters Risk Lives

(*Continued from page 98*)

flavored seeds similar to the butternut in quality.

Still another globe-circling tour of the type that our agricultural explorers frequently make was a recent expedition of Dr. J. F. Rock to Burma, to obtain the seed of the real chaulmugra tree. From this tree comes chaulmugra oil, from which is derived the only cure so far found for leprosy.

After many false quests in different parts of Burma, where he found numerous so-called chaulmugra trees, but few that were bearing the essential fruit and seed, Doctor Rock was finally successful in gathering enough of these remarkable seeds to establish plantations in Hawaii.

While these scientists were searching for their objects in Africa and Burma, Mr. Wilson Popenoe was currying the paths and byways of Guatemala, Costa Rica, Colombia, Ecuador, Peru and Chile, for other plant treasures. During a journey of 6000 miles he secured 23 new varieties of avocadoes, or alligator pears, also the pejibaye, an American cousin of the Egyptian date palm; the Colombian giant blackberry—the world's largest edible berry, growing to a length of 2½ inches—a "white blackberry," several different kinds of South American peaches and apples, a remarkable dwarf orange, and a new type of wild potato.

Germs from Other Worlds

(*Continued from page 97*)

species of living organisms. Its vapor laden atmosphere and sultry climate might conceivably harbor micro-organisms producing a variety of tropical fevers and perhaps, according to a spectacular extension of the theory, to them might even be traced some of the plagues that mysteriously appear on earth.

As illustrated on page 41, when Venus passes between us and the sun, there is afforded an opportunity for such organisms, if they exist, to be transported to Earth. The solar rays, by traversing Venus's atmosphere, hit the dust particles, which may be charged with bacteria, as well as animal and plant seeds, and convey them to the earth in about 20 days. Conversely, germ laden dust is being continually transplanted from our atmosphere to other worlds. And so this interchange of matter may be eternally spreading the same species of life throughout the heavens.

Christmas Gifts You Can Make Yourself

METHODS of making unusual Christmas gifts will be featured in the Home Workshop next month. There will be articles on making toys—an electric train, a kiddie broncho, a doll's house, a toy automobile, a "sledan," and other fascinating novelties prepared especially for POPULAR SCIENCE MONTHLY by some of the best toy designers in the country.

Other stories will tell how to decorate the Christmas tree, how to make a doll radio receiving set; how to prepare marbled paper, and how to build substantial articles, such as an automatic cigarette box and a combination book rack and table lamp, all suitable for presents.

Drawings also will be published, illustrating a simple method of constructing a stage for Yuletide entertainments.

Dividend checks from the American Telephone and Telegraph Company are received quarterly by more than 200,000 telephone users.

Owned by those it serves

Less than fifty years ago an application was made for a patent which created the possibility of speech between distant points. It was the culmination of years of study, research and experiment. It suggested a new aid in commerce and domestic life; a new tie to bind the people together. But it was only a suggestion—a dream.

To make that dream come true required the creation of an organization unlike any other. It demanded a kind of scientific knowledge that was yet to be formulated, as well as a type of equipment still to be devised. And it necessitated the financial and moral support of many communities.

Out of this situation grew the Bell System, bringing not only a new public service, but a new democracy of public service ownership—a democracy that now has more than 200,000 stockholders—a partnership of the rank and file who use telephone service and the rank and file employed in that service. The American Telephone and Telegraph Company exists to serve the people and is owned directly by the people—controlled not by one, but controlled by all.

Evolution is going on. Each year the ownership is more widespread. Each year the various processes of the service are performed more efficiently and economically. Each year new lines and extensions are constructed. The responsibility of the management is to provide the best possible telephone service at the lowest possible cost and to provide new facilities with the growth of demand. To do these things requires equipment, men and money.

The rates must furnish a net return sufficient to induce you to become a stockholder, or to retain your stock if you already are one; after paying wages sufficient to attract and retain capable men and women in the service. They must adequately support and extend the structure of communication.

These are considerations for the interest of all—public, stockholders, employees.

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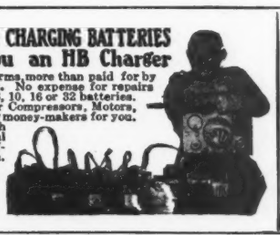

The Midget "Five-in-One" Slide Rule

is a combination Mannheim, Polymetric, Log-Log, Binary, Add and Subtract Slide Rule. It will instantly add, subtract, multiply and divide any combination of whole numbers, fractions, mixed numbers and decimals. Gives every root and power, also Logs, Sines and Tangents. Made of aluminum with scales on white celluloid. Size 4 in. Approved and adopted by colleges.

Price with instructions, $1.50. Leatherette Case 50c. extra. Catalogue Free.

Gilson Slide Rule Co., Niles, Mich.

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Standard Change Gear		Quick Change Gear	
9"x 3' Lathe	$ 176.00	9"x 3' Lathe	$ 216.00
11"x 4' Lathe	228.00	11"x 4' Lathe	276.00
13"x 5' Lathe	304.00	13"x 5' Lathe	354.00
15"x 6' Lathe	376.00	15"x 6' Lathe	431.00
16"x 8' Lathe	452.00	16"x 8' Lathe	512.00
18"x10' Lathe	656.00	18"x10' Lathe	721.00
21"x12' Lathe	933.00	21"x12' Lathe	1,016.00
24"x14' Lathe	1,254.00	24"x14' Lathe	1,353.00

Send for Free Catalog No. 77

SOUTH BEND LATHE WORKS, 433 E. Madison St., SOUTH BEND, IND.

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Bolts and nuts on automobiles, trucks, tractors, stationary and marine engines, farm machinery, etc., *hold* and *stay* tight!

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In assorted sizes in handy bags, retailing as follows: 30 in a bag, 15c; 40 in a bag, 20c; 90 in a bag, 25c. At all good hardware stores. If dealer is out of stock, send name of dealer and order direct.

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"Red Devil" Glass Cutters—the glaziers' standard tools of the world. "It's all in the wheel." Made in 40 styles. No. 024 shown below, 20c.

Your Home Heating Plant

(*Continued from page 78*)

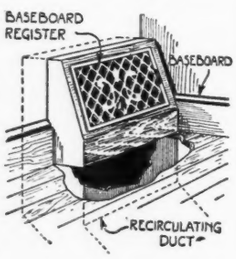
trated, to lead the stream of air into an ordinary stove pipe. This stove pipe projects into the air inlet and points in the direction of the furnace. The end of the pipe should be nozzle-like in shape. To make this, simply split the pipe down at the end in several places and bring the segments together so that they overlap to form a cone; then rivet them together.

To get the maximum benefit of this recirculation system, cover the back of the fan also with a sheet metal casing and run a stove pipe from it either into the new inlet or right up to the first floor, so that all the air blown into the furnace will be from the living-rooms. This arrangement produces surprising results and sometimes saves as much as 22 cents on a dollar's worth of coal, according to heating engineers.

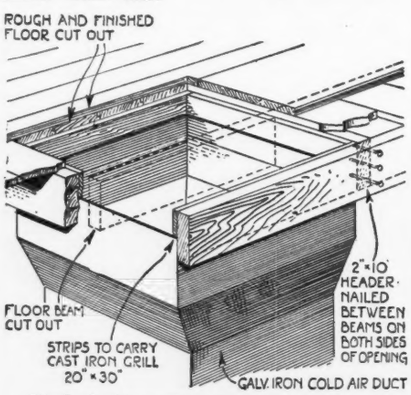
Another method of accomplishing the same result is to place a fan in a tin-lined box with ducts leading to and from the cold air pipe, as illustrated in the left-hand column on page 78.

The fan or blower does not need to be a powerful one; the average household fan will serve the purpose, but a regular ventilating fan or blower has the advantage of being a little sturdier in construction. A motor as small as 1/20 h.p. will serve and when fully loaded consume only 38 watts or about three-fourths of the current consumed by an ordinary electric lamp. Therefore, the cost of operation is small.

The fact that so small a blower unit is required often makes it possible to place it directly in the air duct. When this can be done, it is necessary merely to have a door in the top of the pipe. In every case, however, it is necessary to provide an indoor air inlet if one was not built when the furnace was installed.



A register of the usual type can be purchased, or one can be made with cast iron or steel grillwork, which can be obtained in all kinds of ornamental designs. By making use of this grillwork, it is sometimes possible to put a register in an odd shaped or awkward corner where a commercial size of hot air register would not fit.


ROUGH AND FINISHED FLOOR CUT OUT
FLOOR BEAM CUT OUT
STRIPS TO CARRY CAST IRON GRILL 20" × 30"
2" × 10" HEADER NAILED BETWEEN BEAMS ON BOTH SIDES OF OPENING
GALV. IRON COLD AIR DUCT

Method of installing floor and baseboard registers for recirculating air duct

The radiator, to give the best results from recirculation, should be 18 by 24 in. for a 4-pipe furnace, 20 by 26 for a 6-pipe

(*Continued on page 101*)

A Clean, Sharp Cut—*Everytime!*

—they can't wear out!

Neverslip cutting blades are made from special high carbon crucible steel. That's why they'll outcut and outlast any plier made. Crucible makes a strong tough edge that resists wear and remains sharp for a long time. But if you accidentally nick the edge you don't have to throw the plier away.

For Neverslip Pliers are made with renewable cutting blades—you merely remove the old blades, insert new ones and you have a brand new pair of pliers ready for use at small cost.

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NEVERSLIP
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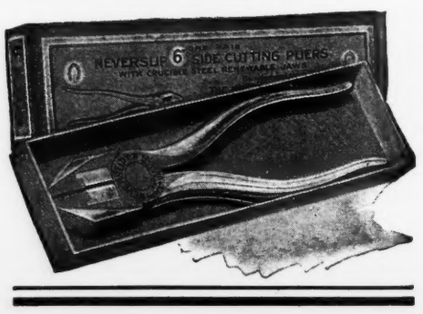
Just go into any hardware store and ask to see a pair of Neverslip Pliers. Look them over carefully. Note the sharp cutting blades. If you want to get real action and long life from a pair of pliers buy Neverslips. Most hardware dealers sell them. Write for leaflet.

THE NEVERSLIP WORKS
New Brunswick New Jersey

Neverslip Pliers are furnished in six seven and eight inch sizes



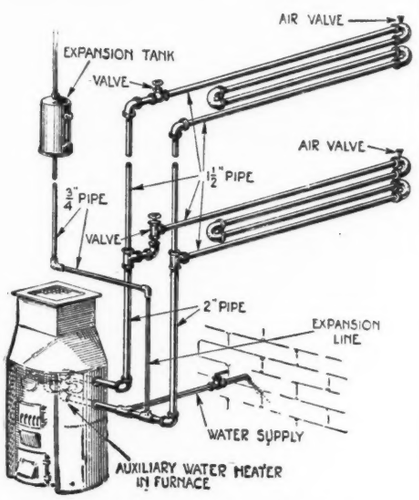
THE HOME WORKSHOP

Your Home Heating Plant

(*Continued from page 100*)

furnace, 21 by 29 in. for an 8-pipe furnace, and 24 by 32 for an 11-pipe furnace. These areas are larger than the sizes of cold air ducts for furnaces of corresponding size.

The location of the register will be determined somewhat by the floor beams, which are placed 16 in. from center to center. Not more than one of these beams should be cut, and then headers should be placed across the opening to hold the ends of the cut beam and to prevent any possibility of the floor's sagging. Because of the danger of striking a nail, an old saw should be used



Auxiliary heating for shut-off rooms may be provided from water heater in furnace

for cutting the opening in the floor. A baseboard register may be used if more convenient.

If the home worker does not care to undertake the sheet metal work himself, he can make a drawing showing the exact dimensions of the pipe and fittings needed and have them made up very reasonably at a tinsmith's shop.

Sometimes the installation can be simplified by using one or two of the existing hot air stacks as intake flues. The pipes going to the hall register and to the register or registers in one or two of the little used rooms of the house can be disconnected from the furnace and connected with the cold air duct. This requires little work and usually very little, if any, additional piping, but it is open to the objection that the area of the combined flues usually is not as large as if a single new inlet is provided. Unless ample provision is made for supplying air to the furnace, it will not give the best results.

In an emergency, a fan often can be used to aid the circulation of air by placing it with its back against a register so as to suck warm air out into the room.

Heating the Bathroom

When pipeless furnaces are used and it is desired to provide heat for the bathroom, nursery or other room that is shut off from the rest of the house for considerable periods, one of the most efficient methods is to install a hot water heating attachment inside the furnace and connect it with a hot water radiator or pipe coils, as illustrated above. Another method is to use a flue,

(*Continued on page 102*)

If you have a radio receiving set using a storage battery, haven't you often wished for a simple efficient means for recharging this battery without lugging it away to a service station?

Tungar
BATTERY CHARGER

charges storage batteries from any alternating current lighting circuit with a minimum of expense and trouble. You can do your charging right in your own home and without lifting the battery from its present position.

The Tungar is not new—thousands have been used for charging automobile starting and lighting batteries for years. Tungar has no moving parts to wear out or require oil. It requires no attention while charging but may safely be left on the battery all night.

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MAKE YOUR FORD INTO THIS SPORT CAR ONLY $6.40
Other types down to $3.50. Famous sure fit, Red-Rid life-size patterns and picture instructions show how. You can easily convert your Ford into this fast, saucy Sport Car as hundreds have done with a few dollars worth of material from the hardware store. No need to lay up the car. The "PAL" with conical disc wheel patterns.

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Sits There Watching a Lifetime of Work

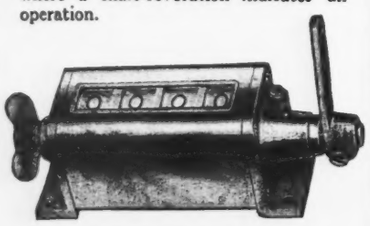
If some mathematical wizard perched himself on your machine, totalled the output at lightning speed and told infallibly how the work was going, what would his services be worth to you?

Would he be worth the price of a Veeder Counter?—you can have him for that price. He's a Veeder Counter personified.

You're paying someone to count the product anyway, at some stage of operations. From now on, count it automatically instead. *Increase the VOLUME* automatically, by counting it in front of the machine *operator*—with a

Veeder COUNTER

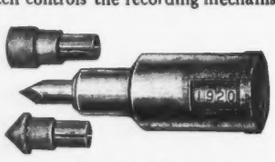
The Revolution Set Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figure-wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter, to record reciprocating movements as on punch presses, $11.50 (list).

Speed Counter

Here's the handiest instrument for finding revolutions-per-minute of a shaft or flywheel. You hold the tip of the counter against end of revolving shaft; press lightly when the second hand of your watch comes to O; release pressure when minute is up. A spring clutch controls the recording mechanism.



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The Veeder Speed Counter enables you to keep motors, engines, generators, line shafting and machines operating at **efficient speeds.** Price, with two rubber tips (as illustrated) $3.50.

Send for free booklet no matter what you want to count—automatically or by hand.

The Veeder Mfg. Co.,
44 Sargeant St., Hartford, Conn.

THE HOME WORKSHOP

Your Home Heating Plant

(*Continued from page 101*)

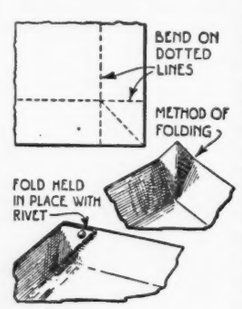
which can be made of a large stovepipe, connecting with the regular hot air chamber or an auxiliary hot air chamber made by incasing part of the smokepipe with a larger pipe.

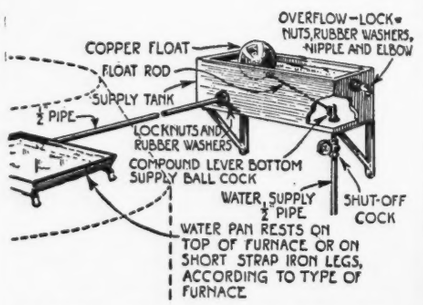
Such a flue, however, usually will not operate unless a fan is placed in front of it, and, therefore, it is generally easier to provide a separate gas, gas-steam, or electric heater for such a room.

Making a Self-Filling Humidifier

When the circulation of air is as good as can be made, it is not difficult to provide for a proper degree of moisture. Most furnaces have a water pan, but usually these are placed in such a way as not to provide a sufficient surface of water for evaporation. The best plan is to keep a panful of water on top of the furnace. It should have as large an area as possible.

The simplest way to obtain one the right size is to make it from a sheet of galvanized iron either by cutting the corners, turning them up, riveting and soldering them, or by bending up the edges and turning the corners in, as illustrated. With the latter method, a single rivet in each corner will hold the pan and no soldering is necessary.




OVERFLOW—LOCK-NUTS, RUBBER WASHERS, NIPPLE AND ELBOW
COPPER FLOAT
FLOAT ROD
SUPPLY TANK
½ PIPE
LOCKNUTS AND RUBBER WASHERS
COMPOUND LEVER BOTTOM SUPPLY BALL COCK
WATER SUPPLY ½ PIPE
SHUT-OFF COCK
WATER PAN RESTS ON TOP OF FURNACE OR ON SHORT STRAP IRON LEGS, ACCORDING TO TYPE OF FURNACE

Typical arrangement of water pan on top of furnace supplied from tank, and suggestion for making pan without soldering

To avoid having constantly to fill the pan, it is well to provide a tank outside and both tank and pan can then be controlled by using a regular float valve. Any one who has had the most elementary experience in pipe fitting will have no difficulty in making the arrangement illustrated. The only point of importance is to provide an overflow in the tank so that in case the valve fails to work for any reason, the water will not flood down on the furnace itself.

To provide the proper degree of humidity in a steam-heated room is even simpler. It is merely necessary to change the air outlet valves on the radiators for some type of commercial valve that is designed to permit a certain amount of steam to escape and mix with the air of the room. The same result can be accomplished in a makeshift manner by taking off the valve cap and turning the adjusting screw a trifle so that

(*Continued on page 103*)

Pay Nothing

An amazing new offer—wear this GENUINE DIAMOND for a week at our expense—absolutely no risk to you—deposit nothing—READ EVERY WORD OF THIS OFFER:

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Just send the coupon below—**do not enclose a penny**—and we will send you on approval at our expense your choice of these diamond rings. The ring illustrated above is the most beautiful hand engraved solid gold ladies' ring you ever saw, set with a fine, large, genuine blue-white diamond. **Pay nothing when it arrives.** Merely accept the ring and wear it for a week, at our expense. After a week decide. If you return the ring, that ends the matter. **You have risked nothing.** But if you keep the ring, send us only $3.75 a month until you have paid the amazingly low price of $38.75 for this regular $50 value. The ring is an elaborate pierced model in solid 14K green gold with hand engraved white gold top. A striking new model. The diamond is a beauty—extra brilliant, blue white, perfectly cut—a remarkably big value. **Men's** extra massive

14K solid gold fluted ring with 18K hand cut white gold top set with extra fine perfectly cut blue-white **genuine diamond.** Extra Big Value. **Now** $38.75—$3.75 a month. Send no money. Pay no C.O.D. A week's trial absolutely FREE. Mail coupon now.

Just mail the coupon below and enclose finger size. SEND NO MONEY—pay nothing on arrival.

Harold Lachman Co., 204 S. Peoria Street Dept. 1788 Chicago

Send me absolutely free and prepaid, for a week's trial, the **genuine diamond** ring checked below. I am to pay nothing when it arrives. After one week I will either return the ring by registered mail and that ends the matter, or I will send you $3.75 each month until $38.75 has been paid. Title remains with you until fully paid. **I ENCLOSE MY FINGER SIZE.**

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Name.....
Address.....
Age.....*Occupation*.....

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For trial, a sample of our style Rubens, if you send 2 cents in U. S. stamps for postage and state size wanted.
Reversible Collar Co., Dept. 116 Boston, Mass.

Your Home Heating Plant

(*Continued from page 102*)

the valve leaks a little and permits the steam to escape.

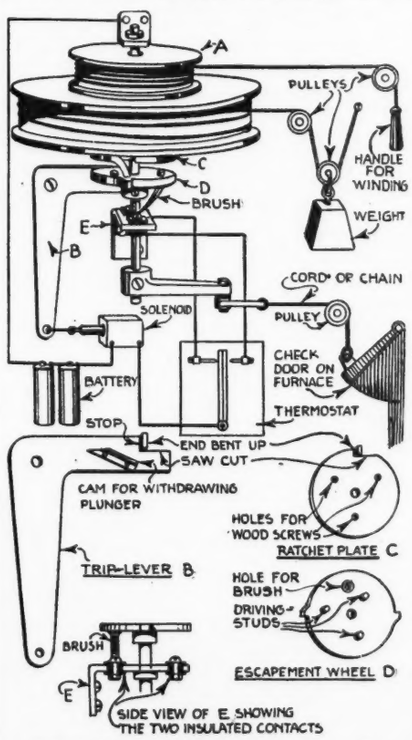
With a hot water system it is difficult to provide sufficient moisture. The amount required is so large that even placing a pan or humidifier on each radiator usually does not help much.

Automatic Heat Regulator Saves Steps

The usual practice of fixing a furnace in the morning and in the evening and allowing it to run with little or no attention throughout the day is not as economical, according to heating engineers, as to maintain an even temperature throughout the day. To do that, however, requires constant watchfulness and this can be accomplished in most households only with an automatic regulator. The one illustrated was designed by Paul H. Byer, of Hagerstown, Md., and not only saved many steps to the cellar, but apparently caused a slight reduction in the amount of coal used.

This device automatically opens and closes the check door of the furnace at any temperature desired and keeps the temperature amazingly constant if the adjustment screws of the thermostat are carefully set.

The power is supplied by one or more batteries which operate the plunger of the



When the adjustment screws on the thermostat are properly set, this apparatus regulates the drafts to provide an even temperature

solenoid and a weight heavy enough to operate the damper. The pulley *A* is made of wood in one piece. The upper part is one half the diameter of the lower part so that the weight will move the same distance as the handle for raising it. The pulley may have a brass tube for a bearing, which should be a loose fit on the shaft.

The ratchet plate *C*, made as shown, is fastened to the pulley by wood screws. The central hole should be larger than the shaft. The escapement wheel *B* is provided with

(*Continued on page 104*)

An Easy Way to Make A Thousand and One Things

IF you like to "make things with your hands," here's something that will help you. When you want to saw a board, cut a groove, smooth a block, sand a joint, grind a tool, buff a piece of metal, or do any one of a thousand similar jobs, you can do them quicker, easier, better and cheaper with the help of this machine than you can by hand. Hundreds of owners are getting surprising results with

Crane's Junior Bench Saw $28.75 Without Motor or Base

A high grade product of remarkable capacity, unusually low in first cost and operating expense. Can be used for a multitude of jobs. Specially adapted for use in wood and soft metals.

Size No Indication of Capacity. Properly constructed to handle an unbelievable quantity of work with remarkable ease. Surprisingly simple, yet powerful in performance. Meets the needs of thousands of men who do light shop work yet who require precision and accuracy combined with convenience and economy of operation.

Things You Can Do with Crane's Junior Bench Saw

For Sawing. Dozens of jobs must be done on a saw—cutting, ripping, mitering, grooving, rabbeting, and tenoning. Does all of these easily and economically on one machine with only a few special attachments. No need for several special machines. Cuts, rips, and miters stock up to 1½ in. thick. Special saws for cutting type metal, brass, copper, aluminum, fiber, bakelite, etc. Can also cut steel tubing, rods, thin plates or sheets of iron, steel, mica, carbon, and similar materials with an elastic emery wheel. Special grooving saws for cutting tenons, and rabbets. Table easily elevated for doing this work. Standard saw slot takes 3-16 in. grooving saw. Wider grooves up to ⅜" can be cut with use of dado head. This work also requires table top with special removable insert for widening saw slot which is furnished for $6.50 extra. Be sure to specify when ordering.

Also adapted for grinding, buffing, sanding, etc., merely by attaching necessary tools, such as emery wheels, sand discs, etc., to outer end of saw arbor.

Tilting Top for Beveling. This is an important feature. Top can be tilted five degrees to left and ten degrees to right, or locked securely in flat position. This feature particularly advantageous on pattern work to obtain draft without planing. Top also hinged for convenience in grooving and to give easy access to arbor, pulley, saw, and bearing. All guides in accurate alignment for precision work.

What Users Say: "It is a peach of a saw." "Am well satisfied." "Have ripped nearly 1,000 ft. of White Cedar in lengths from 16 ft. to 27 ft. It did as well as large rig could have done." "Is everything we could hope for." "Would just as soon have it as saw costing five to ten times the price." Many more like them. Not a single dissatisfied customer.

Who Can Use It. The Crane Junior Bench Saw is particularly adapted for use of carpenters, contractors, cabinet and pattern makers, furniture repair men, toy makers, shipping departments, laboratories, printers, private work shops and any other similar places where speed, precision, and economy of operation are required.

What You Get.—Our Special Offer. For a limited time we offer the Crane Junior Bench Saw with rip guide, cut-off guide and 6" wood saw, all for $28.75 f. o. b. factory, cash to accompany order. (A 5" metal saw may be substituted for wood saw.) Same machine mounted on iron base with ¼ h.p. 110 volt, 60 cycle ball-bearing motor, belt, belt tightener, cord, plug and switch, $60.00. 1/3 h.p. motor $63.00. Prices with other motors quoted on request.

Specifications. All metal construction; height 7"; bronze bearings, with grease cup; table top 10"x 13", planed smooth and true; flanged pulley 1½" diameter for 1¼ belt. (Grooved pulley if desired.) Speed 3500 rpm. Power required ¼ or 1/3 h.p. Finish, dull black; weight 40 lbs.; shipping weight 50 lbs. Will cut 1¼ stock.

Our Guarantee. Send for a CRANE JUNIOR BENCH SAW and use it ten days. If at the end of ten days you are not satisfied, return machine at our expense and get your money. Purchase price will be gladly refunded.

Ask for prices and descriptive literature on other Boice Machines and Motors. Satisfaction guaranteed. Prices lowest consistent with a quality that gives service. Use the coupon.

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FILL OUT AND MAIL THIS COUPON

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Dept. P.S. 11, 112-23rd St., Toledo, Ohio

Enclosed is money order for $28.75 for which please send me one Crane Junior Bench Saw with equipment specified, as per your special ten day trial offer.

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If 1-3 hp. motor at $63.50, check here. . . . . .

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Does this smoker know what he's talking about?

He says the best pipe of the day is the first one

A smoker from Zanesville, Ohio, who prefers to conceal his identity under the initials "A.K.K.," insists that the after-breakfast pipe is far and away the best pipe of the day.

"Of course," writes A.K.K., "it depends somewhat on the breakfast. I couldn't get much joy out of a pipe after getting up from burnt oatmeal, bad coffee, and soggy toast. But after one of the breakfasts my wife can turn out, that's different!

"Then when I step out on the porch and light up the old pipe, I very nearly approach the pinnacle of my day. As I figure it, one puff after breakfast is worth a dozen puffs after dinner.

"But please don't let this preference of mine for an early-morning pipe in any way injure my standing as an inveterate pipe smoker. I smoke from breakfast until bedtime and get a lot of pleasure out of each pipe, provided always that I use the right kind of tobacco."

At this point it seems only fair to admit that A. K. K. is an Edgeworth smoker.

Thousands and thousands of smokers all over the country have discovered that Edgeworth is just the "right kind of tobacco" to suit their tastes.

Edgeworth may or may not be the right kind of tobacco for you. At least we want to give you the opportunity of finding out just what you do think about it.

Just jot your name and address down on a postal and we will send you immediately free samples, both of Edgeworth Plug Slice and Ready-Rubbed. If you will also include the name and address of the dealer from whom you usually purchase your tobacco supplies, we will appreciate the favor.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome tin humidors, and also in various handy in-between sizes.

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To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Ready-Rubbed for the same price you would pay the jobber.

THE HOME WORKSHOP

Your Home Heating Plant

(*Continued from page 103*)

three or more studs, a hole for the brush screw, and two teeth or studs in its circumference 180 degrees apart. This piece is held securely to the shaft by a setscrew.

The trip lever *B* is provided with a cam made by bending a small piece of steel at an angle and riveting it in the position shown. A stop is made by sawing back a short distance from the end of the lever and bending the strip out. The thermostat is made by riveting together pieces of copper and zinc and fastening them at the end so that they can swing back and forth between the adjustable contacts. The unequal expansion and contraction of the two metals cause the arm to bend one way or the other in proportion to the temperature changes.

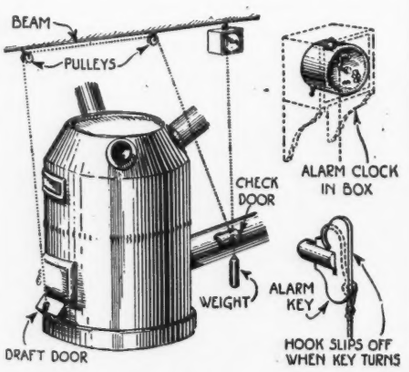
The thermostat makes contact for hot or cold, as the case may be, by bending to touch one or the other contact screws. When the contact is made, the plunger of the solenoid is drawn in. This moves the trip lever *B*, and releases the escapement wheel so that one tooth passes by. This tooth comes in contact with the cam and while passing over the cam causes the plunger to be withdrawn. The other tooth in the escapement wheel then comes in contact with the stop.

During this operation the shaft and crank on the end have moved through 180 degrees and the brush makes contact with the other terminal of the thermostat, so that the device is set for the time when the thermostat bends the other way and makes contact with the opposite screw.

To install a commercial type heat regulator it is usually necessary merely to mount the thermostat on an inside partition. The cable carrying the electrical connection is passed through a hole back of the thermostat and dropped down between the studs to the cellar. The only difficulty is to fish the cable through the floor. The regulating motor, whether spring or electric, is placed on brackets near the furnace in a position convenient for running chains to the draft and dampers.

Alarm Clock Opens Drafts

An alarm-clock regulator is easily installed even when a thermostatic regulator is not used. It costs little and serves for closing the dampers and opening the draft.



The device adapted for a standard hot air pipe furnace

This saves making a trip down into the cold cellar the first thing in the morning. The principle of operation is simply that

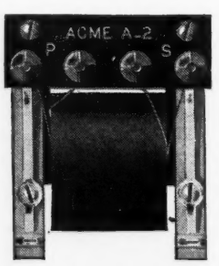
(*Continued on page 105*)

Choke off that "squawk"

AFTER all it is not always the bad vaudeville actors that "get the hook." Many owners have found an efficient hook to choke off the "squawk" of their radio sets and secure enjoyable music by adding Acme *Audio* Frequency Amplifying Transformers to the ordinary detector unit. Acme Transformers cost but five dollars, yet the results are almost marvelous. Not only do they amplify sound, but they bring it naturally—realistically. They are necessary to the proper operation of the Acme Clear Speaker which enables a whole roomful of people to enjoy the broadcasting concerts.

In order to get more than one broadcasting station and thereby pick out the concert you like best, you should also add an Acme *Radio* Frequency Transformer. This greatly increases the range of your set whether it be vacuum tube or crystal detector type. This wonderful little transformer sells for the same price as its twin brother the Acme *Audio* Frequency Amplifying Transformer. Your set is not complete without both these transformers and the Acme Clear Speaker.

The Acme Apparatus Company (pioneer transformer and radio engineers and manufacturers) also make detector units, the Acmefone, Acme C. W. and Spark Transmitters, etc. Write for interesting Transformer booklet if your own radio or electrical dealer cannot supply you. The Acme Apparatus Company, Cambridge, Mass., U. S. A., New York Sales Office, 1270 Broadway.



Type A-2 Acme Amplifying Transformer
Price $5 (East of Rocky Mts.)

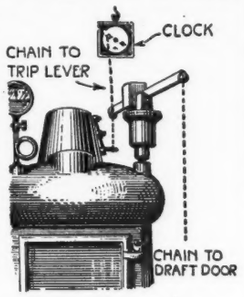
ACME
for amplification

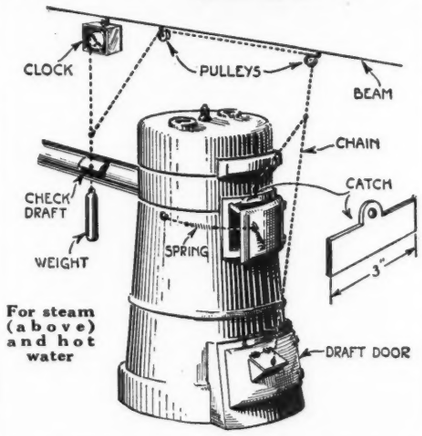
THE HOME WORKSHOP

Your Home Heating Plant

(*Continued from page 104*)

when the alarm clock rings, it unhooks a weight that operates the drafts and dampers. The various arrangements of chains for hot air, steam, hot water or pipeless furnaces are made clear in the accompanying illustration. A few yards of chain, an ordinary alarm clock, a door spring, two pulleys, a sash weight or other lead weight

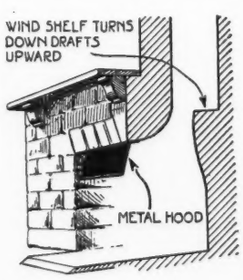




weighing from 6 to 8 lbs., will have to be purchased, and a small brass catch made for holding open the firebox door, in case it is the practice to open that door at night to check the fire.

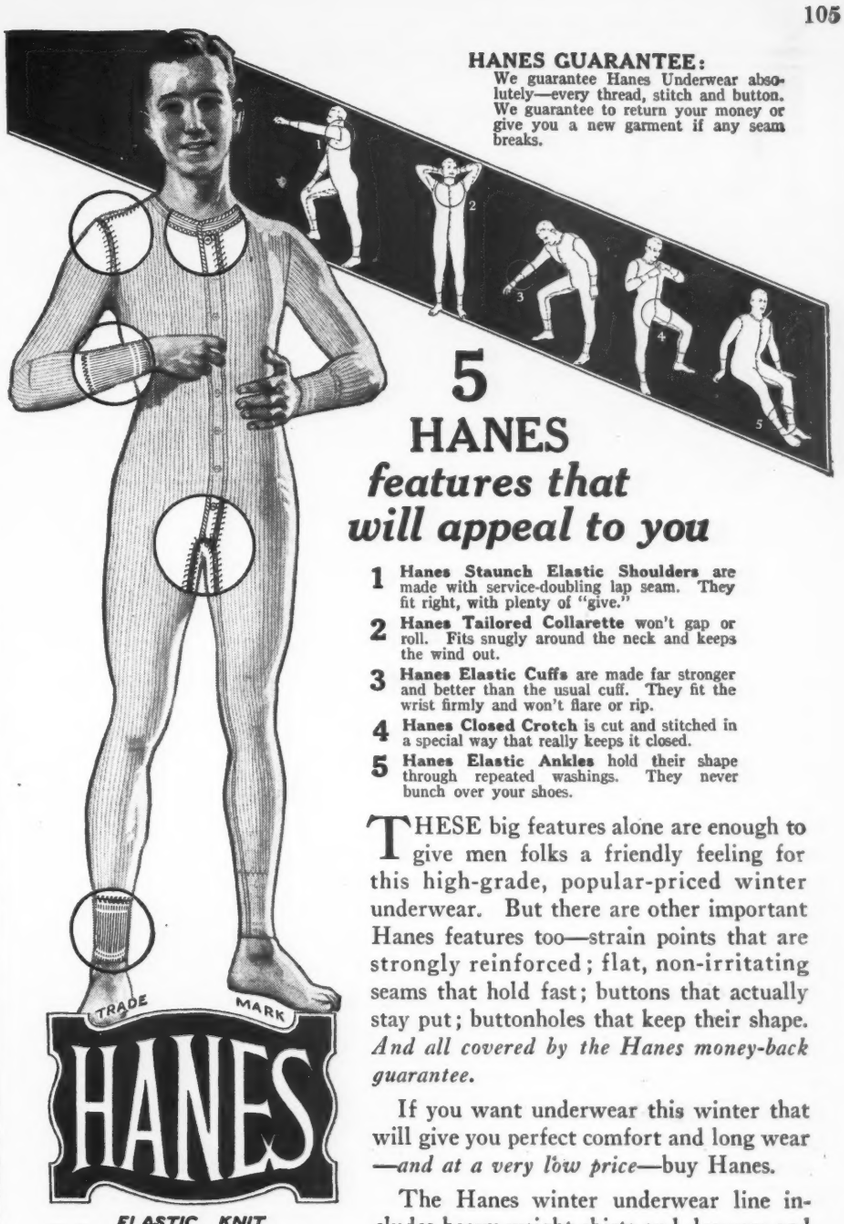
The alarm clock should be inclosed in a box to protect it from the dust. The weight is attached to a length of chain and a hook in the other end is placed over the alarm winding key. When the alarm rings, this key turns and permits the key to slip off, thus dropping the weight. This operates the drafts and dampers directly, except in the case of the firebox door, in which case the catch, above referred to, is jerked out from between the open door and the door frame, and thus causes the spring to shut the door.

Obsolete as open fireplaces are, they nevertheless, in a time of coal shortage, offer a supplementary source of heat, because they will burn all sorts of odds and ends of wood that otherwise would be wasted. Even newspapers rolled into bundles and burned in the fireplace throw out a surprising amount of heat.



Many fireplaces, however, especially small ones in modern houses, are apt to smoke. This usually is due to poor design, the fireplace opening being too large in proportion to the smoke flue. It is difficult to do much without reconstructing the fireplace, but often the fireplace can be made to draw better simply by reducing the front

(*Continued on page 106*)



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4 **Hanes Closed Crotch** is cut and stitched in a special way that really keeps it closed.

5 **Hanes Elastic Ankles** hold their shape through repeated washings. They never bunch over your shoes.

THESE big features alone are enough to give men folks a friendly feeling for this high-grade, popular-priced winter underwear. But there are other important Hanes features too—strain points that are strongly reinforced; flat, non-irritating seams that hold fast; buttons that actually stay put; buttonholes that keep their shape. *And all covered by the Hanes money-back guarantee.*

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The Hanes winter underwear line includes heavy-weight shirts and drawers and heavy union suits in two weights.

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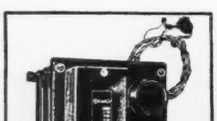

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177 N. State St. Dept. 11-65 Chicago

THE HOME WORKSHOP

Your Home Heating Plant

(*Continued from page 105*)

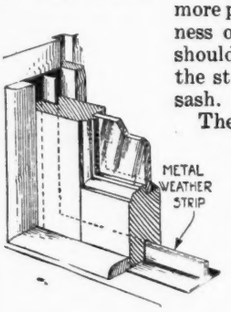
opening with a hood. This can be made at home of sheet iron or a hood may be purchased and fixed into the fireplace.

A great deal can be done to conserve heat in houses, stores and offices by preventing unnecessary waste of warm air.

The first thing for the home worker to do when cold weather starts is to place weather strips on doors and windows. (See illustration at bottom of page 78.)

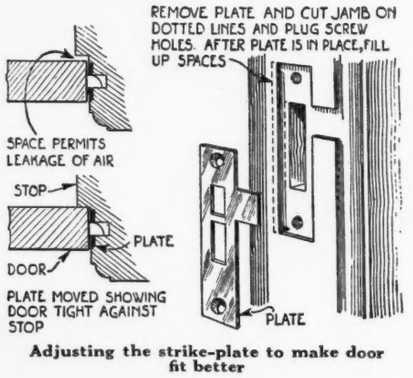
Try each window in turn and see if the sash rattles. For each window that is not absolutely tight, obtain 8 or 9 ft. of ordinary weather strip. This should be nailed with 1-in. brads to the blind-stop around the side and top of the window frame, outside the upper sash. Carry down the strips as far as the lower edge of the meeting rail. Be sure to press the weather strip against the sash so that it is a snug fit and yet not so tight that the sash sticks.

If the sash lock does not pull the meeting rails close, take off half of the catch, plug the holes, and replace it farther from the other so that the cam action will draw the meeting rails tightly together. If this does not make the window perfectly airtight, pry off the window stops, which are strips about ½ by 1½ in. on the inside, remove the nails by pulling them through the back, or cut them off and nail the stops back so as to hold the sash tightly. No more play than the thickness of a piece of paper should be left between the stops and the lower sash.



The upper sash should have sufficient room to slide easily when started. It is not necessary to apply weather strips to the lower sash as a rule, although metal weather strips of ingenious design can be obtained for going all around windows, even under the bottom rail, and making them almost completely airtight. To attach this kind of weather strip, ordinarily the sash must be removed; but the strips can remain on all the year, as they practically become a part of the window.

It is equally important to have the outer doors fit well, especially if storm doors or vestibules have not been provided to form insulating pockets of air. The first step in fixing a door that is not tight is to remove the strike plate in the door jamb, plug the


REMOVE PLATE AND CUT JAMB ON DOTTED LINES AND PLUG SCREW HOLES. AFTER PLATE IS IN PLACE, FILL UP SPACES
SPACE PERMITS LEAKAGE OF AIR
STOP
PLATE
DOOR
PLATE MOVED SHOWING DOOR TIGHT AGAINST STOP
PLATE

Adjusting the strike-plate to make door fit better

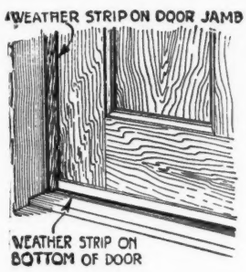
(*Continued on page 107*)

THE HOME WORKSHOP

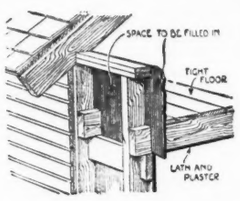
Your Home Heating Plant

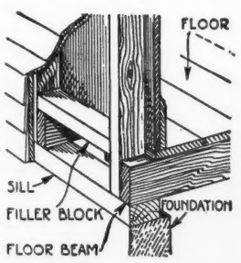
(*Continued from page 106*)

screw holes, chisel the mortise a little wider, and refit the plate so that it will hold the door closer to the door stop. A piece of weather strip should then be fastened on the bottom of the door with 1-in. brads or 1-in. No. 6 round-head screws. Place this on the side where it will not interfere with the opening of the door. If there are still any cracks, nail weather strip on both sides and at the top of the door-jam outside so that the rubber will press gently against the door when it is closed and locked. With exceptionally bad doors, it is sometimes advisable to nail strips of regular door stop ½ by 1½ in. around the jam so that it will be a tight fit against the door, and then place weather strip on top.



When the doors and windows are all tight, it is well to see if there are any places where warm air can escape from warm rooms either to the cellar or attic or through the house wall. The wall of a frame house itself is usually built so as to contain a number of air cells, as it were, since the building regulations usually provide for fire stops and the like to break up the long spaces between studs. Take the precaution, however, to see that none of these wall spaces, which are so important in insulating the house, open into the attic or cellar. If any of them do, cover the spaces with building paper, wallboard, plaster board, or strips of wood. If the attic is of the unfinished variety and has no floor, the beams should be carefully covered with building paper, if nothing better, so as to provide a "dead" air space between the ceiling of the rooms on the upper floor and the attic.



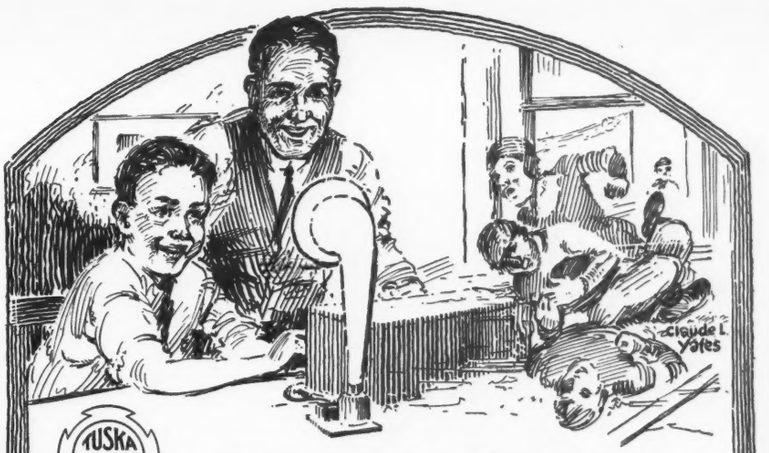


In the same way, if there are any places where the cellar air can penetrate between the inner and outer walls of the house, those openings should be closed with building paper.

The importance of taking these precautions becomes more apparent when it is remembered that lath and plaster do not form a good insulator. That is why it is desirable to have a layer of building paper over the inside of the studs as well as between the sheathing and the siding or other finishing material on the outside of a frame dwelling.

Dead air spaces are the best insulators

(*Continued on page 108*)



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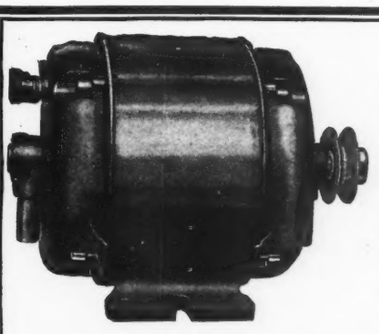

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THE HOME WORKSHOP

Your Home Heating Plant

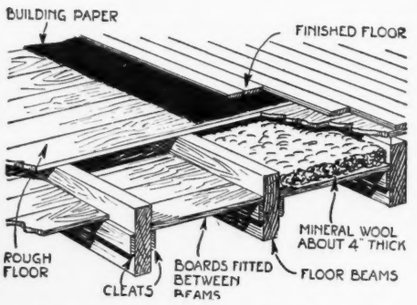
(*Continued from page 107*)

of relatively low temperature. Therefore, if it is desired to insulate the hot air pipes in the cellar, they should be covered with corrugated insulating material or asbestos at least ¼ in. thick and not with solid asbestos, cement or paper. Conversely, if pipes—such as steam or hot water—are radiating heat at relatively high temperatures, they are best insulated with solid material.

The customary way of insulating pipes of the latter kind is to cover them with 1 in. thick asbestos or magnesia sections, covered with canvas. These sections are secured in place by lacquered brass bands.

Another method is to apply asbestos cement, which is obtained in powdered form and mixed with water. This is then covered with canvas and usually a coat of ordinary cement and water is applied to the whole with a brush.

In the various types of moderately priced frame dwellings now being built in vast numbers throughout the country, projections from the first floor are often used to break up the monotony of the otherwise boxlike construction and to give additional floor space without a corresponding increase of the cost of the foundation. Since these projections are usually exposed to the



Method of placing mineral wool beneath floor. It also can be packed between inside and outside walls where necessary

weather underneath, it is most important that the floors should be properly insulated.

The standard method of providing this insulation, and the easiest for the home worker to apply, is to place a layer of mineral wool below the floor, as shown. Even ashes are better than nothing.

Storm sash, doors, and porches should always be placed on an exposed side of a house facing the prevailing winter winds.

It is not difficult to fit and hang sash. Two thin rods should be used for measuring. Cut one the exact height of the window frame opening, and the other, the width. Test each sash with these and, if it is too large, plane it off. Bevel the bottom edge to conform with the slant of the sill.

Special hardware can be obtained for hanging the sash and to allow it to be pushed open at the bottom for ventilation. Sash also can be obtained with one small pane, arranged to open like a small door, for purposes of ventilation, or with a ventilator in the bottom sill.

It is possible for the home worker to make his own sash without much difficulty and at some saving in expense. One of the simplest ways of doing this was described in POPULAR SCIENCE MONTHLY for last February, and working drawings for a simple, yet unusually attractive looking storm porch were given in the Home Workshop Department of last January.

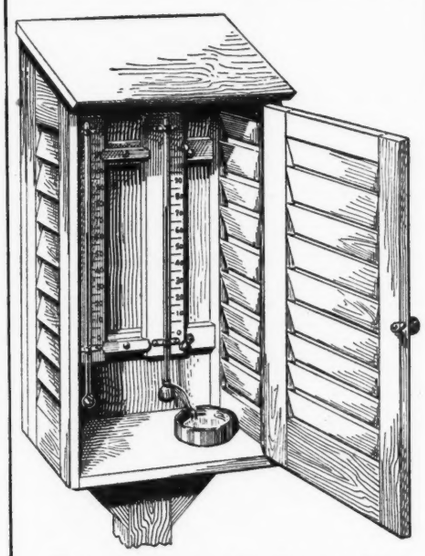
THE HOME WORKSHOP

Easily Made Hygrometer Will Measure Humidity in Air

By Capt. E. A. McCann

ONE of the secrets of heating a house economically and efficiently and keeping it comfortable through the winter months is to provide a sufficient amount of moisture for the air. If the humidity is right, a temperature of 65 or 67 degrees will feel as warm as a temperature of 70 degrees or more when the air is dry.

The humidity indoors should be approximately 50 per cent, according to competent heating and ventilating authorities. That is, the air should have half as much moisture as it is capable of holding. We could not live in perfectly dry air, and generally speaking the best degree of humidity for us is about 66 per cent, but with ordinary heating plants it is usually next to impossible to maintain even 50 per cent humidity inside our homes in winter.



The hygrometer consists of a wet and dry thermometer, the readings of which are compared in computing the humidity. For indoor use the instrument does not need to be housed

Temperature and water vapor in the air are, indeed, governing factors of climate and determine the wind and weather of the world, our various climates, and with them, our health and temper.

Humidity is measured by means of a hygrometer. This instrument consists in its simplest form of two thermometers, one wet and the other dry. To make one, therefore, you will require two thermometers. Be careful to see that they register evenly. They are suspended side by side and if they are to be used outside, they should be sheltered in a wooden screen standing about 5 ft. from the ground, with jalousies on three sides so that the air may freely circulate within but the sun and rain be excluded. The top should be slanted and project well from the sides all round. The bottom preferably should have jalousies like the sides.

The two thermometers are kept in position by brass clips or thumbscrews so that they can be removed for cleaning. The bulbs descend clear of the scales or supports.

Around one bulb tie a piece of thin muslin and fasten a few strands of cotton wick to

(*Continued on page 110*)

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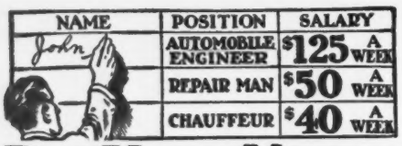

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THE HOME WORKSHOP

Homemade Hygrometer

(*Continued from page 109*)

the glass tube above, letting them come in contact with the muslin. The strands descend into a small vessel of distilled or clean rain water, placed near the wet and as far as possible from the dry bulb. This arrangement keeps the one bulb wet and the evaporation cools it and causes that thermometer to register lower than the other, the difference varying with the amount of free moisture in contact with the dry bulb.

Reading the Hygrometer

After you have taken the readings of the wet thermometer and the dry thermometer, subtract the first from the second. If the difference is less than 10, consult Table No. 1; if 10 or more, look at Table No. 2.

In either case, follow down the left-hand column until you reach the number nearest to the reading of the dry thermometer.

From that point follow straight along to the right until you reach the column directly under the figure (on the upper line) that represents the difference in reading between the wet and the dry thermometers. At that point you will find the percentage of humidity. For example: Wet thermometer, 54; dry thermometer, 67; difference, 13; humidity, 39.

TABLE No. 1

Dry Thermometer	Difference in degrees between dry and wet thermometers when less than 10 points								
	1	2	3	4	5	6	7	8	9
0	67	35	.	.	.	.	.	.	.
5	74	48	22	.	.	.	.	.	.
10	78	57	35	14	.	.	.	.	.
15	82	64	47	29	12	.	.	.	.
20	85	70	56	41	27	13	.	.	.
25	87	74	62	50	38	26	14	3	.
30	89	78	67	57	47	36	26	17	.
35	91	82	73	65	54	45	37	28	19
40	92	84	76	68	60	53	45	38	30
45	92	85	78	71	64	58	51	44	38
50	93	87	80	74	67	61	55	50	44
55	94	88	82	76	70	65	59	54	49
60	94	89	84	78	73	68	63	58	53
65	95	90	85	80	75	70	65	61	56
70	95	90	86	81	77	72	68	64	60
75	95	91	87	82	78	74	70	66	62
80	96	92	87	83	79	75	72	68	64
85	96	92	88	84	80	77	73	70	66
90	96	93	89	86	82	79	76	72	69
95	96	92	88	85	81	78	75	71	68
100	97	93	90	86	83	80	77	74	71

(Percentage of humidity)

TABLE No. 2

Dry Thermometer	Difference in degrees between dry and wet thermometers when 10 or more points								
	10	11	12	13	14	15	16	17	18
40	22	16	8	.	.	.	.	.	.
45	32	25	19	13	7	.	.	.	.
50	38	33	27	22	16	11	6	.	.
55	43	39	34	29	24	19	15	10	6
60	48	44	39	34	30	26	22	18	14
65	52	48	44	39	35	31	28	24	20
70	55	52	48	44	40	36	33	29	26
75	58	55	51	47	44	40	37	34	31
80	61	57	54	51	47	44	41	38	35
85	63	60	56	53	50	47	44	41	38
90	66	63	60	58	55	52	49	47	44
95	65	62	59	58	56	53	50	47	44
100	68	65	62	59	57	54	51	49	47

(Percentage of humidity)

When taking readings, be careful to note that the wet bulb is wet, and the dry one dry; if the latter has become wet, it will register as a wet bulb for the time being.

(*Continued on page 111*)

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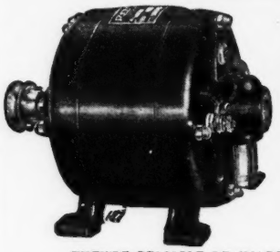

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Homemade Hygrometer

(*Continued from page 110*)

For indoor use the screen is not necessary. With the temperature of a room at 50 degrees, each cubic foot of air should contain 3 gr. aqueous vapor; at 60 degrees, 4 gr.; at 70 degrees, 5 gr.; that is, when the dry bulb stands at those points, the wet should show 45, 54, and 63 degrees respectively to give 66 per cent humidity. The figures are not the absolute amount of water vapor in the air, but the relative humidity with regard to the temperature at the time, because warm air holds more moisture than cold. Thus at 32° F., 1 c. ft. of air can hold nearly 3 gr. of aqueous vapor; at 60 degrees it will gold 6 gr.; then for every increase of 27 degrees the holding capacity of a cubic foot is doubled. At a temperature of 30 degrees, for instance, the relative humidity of 90 per cent corresponds to 0.149 in. of vapor pressure, while 60 per cent at 80 degrees equals 0.511 in., or more than three times as much.

Hygrometer Not Affected by Frost

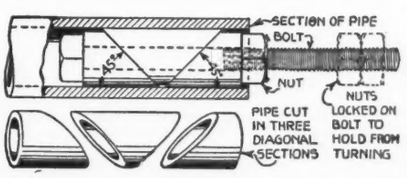
In frosty weather, when the muslin is thinly coated with ice, the readings are still valid, because evaporation takes place as freely from the surface of ice as from water, but if it is dry, wet it and let it freeze.

You can often foretell frost with this instrument, and so perhaps save delicate plants. When the temperature is below 45 degrees, take the difference between the readings and multiply by 25, subtract this from the reading of the dry bulb, and the result will indicate approximately the temperature to which the air will fall during the coming night. Moist winds or increasing cloudiness will, of course, sometimes falsify this forecast.

How to Fasten a Bolt in End of Pipe or Radio Mast

ON MANY occasions it is necessary to make a fastening at the end of a pipe in connection with a wireless mast, awning work, hand rail attachments, framing, and the like.

To hold a bolt in the open end of a pipe and leave the end portion protruding is



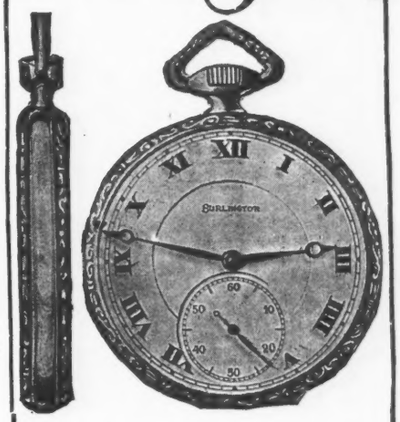
Tightening the nut expands the three pieces of pipe in the bore

easily accomplished in such cases if the method illustrated is followed.

First obtain a 4- or 5-in. length of pipe smaller in diameter than the pipe to which the bolt is to be secured. Saw *two* cuts diagonally across the piece so as to separate it into three parts. The bolt is placed through these and they are inserted in the end of the pipe. The nut is then set up solidly so that the outside of the segments presses against the inside of the pipe.

The bolt can be tightened by taking up the nut. To hold the bolt from turning while tightening the nut, lock two nuts tightly at the end of the bolt to give a grip.—G. A. LUERS.

21 Jewel Burlington



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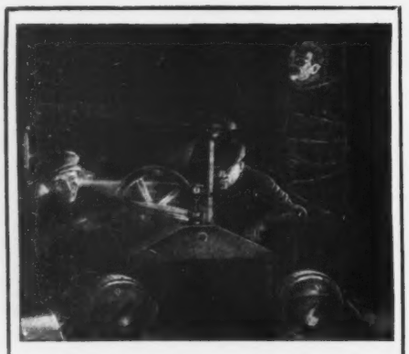

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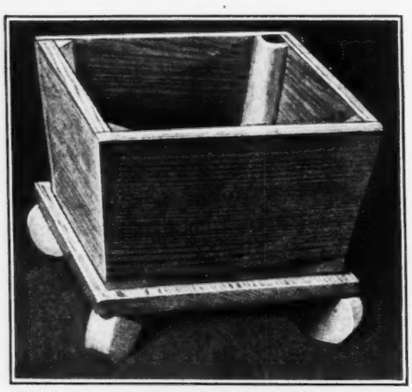
THE HOME WORKSHOP

Easily Made Wooden Flower Box Has Water Reservoir

HOUSE plants flourish in the wooden flower box illustrated, which has a self-contained reservoir for water. The water is poured down the tube shown in the upper right-hand corner of the photograph, and rises from the bottom up into the soil. This prevents the caking of the earth around the plant.

Above the bottom of the box is a second bottom, the space between being about 5/16 in. in depth. This second bottom is not fitted closely because room must be allowed for expansion and to permit the water to rise. The inner bottom also has a



Water poured through hole visible in upper right-hand corner is stored between double bottoms

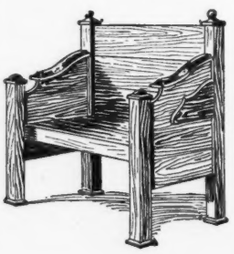
1¾-in. hole in the center through which the water passes upward. This hole is filled with a sponge to prevent the earth from falling through into the reservoir. Four short lengths of dowels are set into the under surface of the inner bottom to hold it up.

Making this box is what teachers call a butt-joint job and is, therefore, comparatively simple, but the joints have to be watertight, so good workmanship is required. The first model was made with mitered joints, which look better but are more difficult. Many of the boxes my pupils have made were strengthened with copper bands ⅝ by 2 in., fastened around the corners at the top with copper upholstery nails.—P. S. HALLECK.

Old Wooden Bed Is Cut Down to Make a Settee

IF YOU have an old wooden bed stored away in the attic, it probably can be made into a useful and attractive settee.

Finishing nails and about six 3-in. screws were all the additional materials needed to make the settee illustrated, and the tools required were a saw, a hammer, and a screwdriver.



The footboard was cut in half to make the ends and arms of the settee. The side rails and some of the slats were used for the seat, and the high headboard, which was to form the back, was cut down and some of the unnecessary ornamental work at the top removed, resulting in the settee shown above.—E. W.

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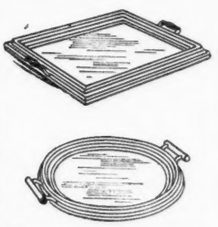
THE HOME WORKSHOP

Discarded Picture Frames Make Attractive Serving Trays

OLD picture frames can be converted without much difficulty into substantial and attractive serving trays. In most attics there are old pictures with elaborately molded frames that have been put aside because either the picture or the frame has become old-fashioned. Often the frames are of walnut with moldings of good design, so that they will serve for making exceptionally fine serving trays.

The large serving tray illustrated, which is 14¾ by 19¾ in., was made from a frame that happened to be about the size of a regular serving tray. If the frame happens to be too large or is an odd shape, it can be cut down to the desired size and shape.



Square and oval trays

Cretonne, good reproductions of pictures that have decorative quality, Japanese prints, or commercial silhouettes, such as are sold for lampshades, can be used effectively underneath the glass. A study of commercial trays in a first class furniture store will provide suggestions for arranging these decorations. Sometimes an old, much prized pennant or a piece of embroidery or lace will prove attractive.

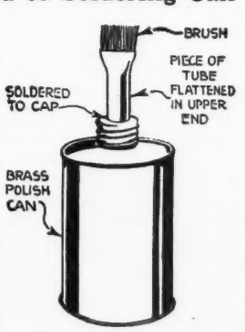
Brass handles, made especially for these trays, can be purchased reasonably. The bottom of the tray should be covered with felt, well glued on.

If an oval frame is available, it also may be used for a serving tray, even if quite small. Often such a tray looks better if it has wooden handles, and these too can be made at home. They should be of the same kind of wood as the frame, the handles themselves being about ¾ in. in diameter, and the rods by which they are connected with the frame ½ in. or less in diameter. Holes for these rods are drilled into the frame at an angle, and the rods are glued in place.

The first step in finishing a tray is to remove all the old finish from the frame. This can be done with a varnish remover, which will penetrate into all parts of the molding. Sandpaper the parts smooth and apply a coat of walnut, mahogany, or other stain, followed by two or three coats of shellac, rubbing down each coat a little with fine sandpaper. Then apply wax or varnish.—GLADSTONE CALIFF.

Brush Fastened to Soldering Can

WHEN a number of parts have to be brushed with soldering fluid, it is a good idea to combine a brush with the container. This can be done by fitting a piece of tubing into the top of a can that has a screw cap, and placing the brush inside the tube. The end of the tube should be flattened slightly to hold the brush securely.—H. B.



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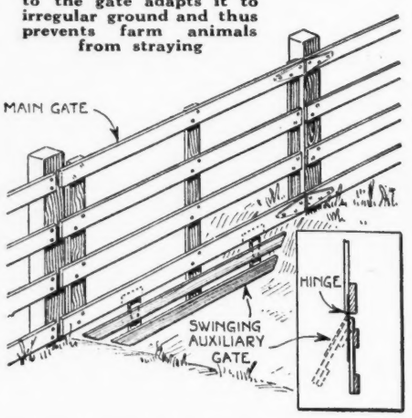
THE HOME WORKSHOP

Adapting a Farm Gate to Suit a Depressed Road

AN ANNOYING feature of roads under farmyard gates is that the road will wear down and soon leave a space beneath the gate through which the smaller animals will find their way.

Here is the way in which one farmer solved the problem. He hinged an auxiliary gate underneath the main gate in such a manner that when the gate was opened and swung back against the bank of the road, the lower gate swung up, returning to position of itself when the gate was again closed.—LOUIS SCHNEIDER.

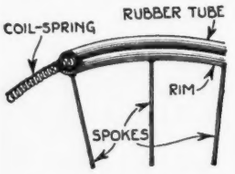
This flood type of extension to the gate adapts it to irregular ground and thus prevents farm animals from straying



Spring and Tube Used to Re-Tire Baby Carriage Wheels

WHEN a baby-buggy tire wears out, often it is found difficult to secure and to put on a new one. The following method will be found very simple, cheap and practical, and anybody with ordinary mechanical ability can utilize it with ease.

Obtain heavy rubber tubing long enough to fit around the rim of the wheel, and steel wire spring long enough to fit the rim when the spring is stretched about two inches. The spring must be of such size that it can be easily pulled through the hole in the rubber tubing. The ends of the spring are fastened together. This makes a rubber tire that can be easily sprung in its place on the rim of the wheel.



A quick and durable repair

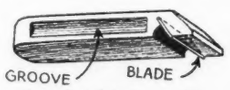
It was found that heavy rubber tubing with thick walls containing some cotton, is used for gas-stove connections and can be secured at hardware stores. This tubing was made to serve the purpose and wears unusually well. The wire spring used is the ordinary screendoor or bird-cage spring. These are too short for the average size wheel and it is necessary to splice two pieces to make the proper length. The splice must be as smooth as possible, so that no free wire ends are left to puncture the rubber tube.—MRS. E. K.

IF YOUR radio set is one of several stages of amplification, try the effect of changing around the amplifying tubes. A new arrangement will sometimes make a big difference in the signals.—S. H.

THE HOME WORKSHOP

Razor Blade Utilized as Cabinet Scraper for Fine Work

A HANDY and useful scraper for cabinet work can be made by inserting a safety razor blade in a wooden holder, as shown. The opening in the handle, which is a piece of soft wood, is cut on a scroll-saw or in any convenient manner, and a piece is also removed from the back to allow the shavings to escape. The shape of the handle is such that the blade stays in place while in use, yet can easily be removed. Any type of safety razor blade will serve and one blade will last for some time before it becomes dull.

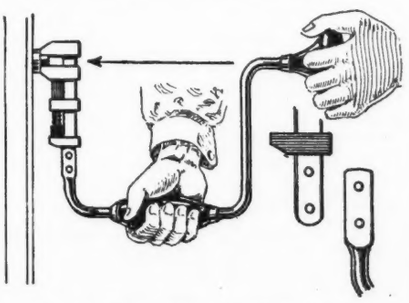


For finishing small surfaces

This scraper is useful on fine cabinet work where an ordinary scraper would be too large. For example, one was used in finishing the end rails of an old table. It is also valuable for smoothing inlays. In places where even this scraper is too large, a safety razor blade alone may be utilized.—G. C.

Adjustable Socket Wrench Made with Old Bit Brace

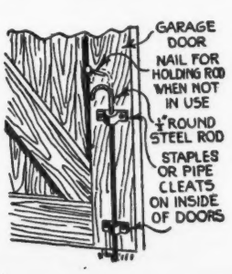
IF YOU happen to have an old bit brace that has outlived its usefulness, you can convert it into an adjustable socket wrench. Saw off the chuck and heat and flatten the end so that you can attach to it a small


A powerful and speedy wrench for accessible work

monkey-wrench from which the handle has been removed and the shank cut down. Flatten the end of the wrench shank and place it against the flattened end of the bit brace so that the jaws of the wrench are directly under the round brace handle. In this position the two may either be riveted or bolted together.—S. W.

Stop Holds Garage Doors Open

THE stop illustrated will eliminate the danger of garage doors being blown against the car while entering or leaving the garage. A ½-in. round steel rod bent into a hook at one end and sharpened to a point at the other is held in place on the inside of the doors by two staples or ½-in. pipe cleats. A heavy nail or hook is driven into the door to provide a hanger for the stop rod when the doors are being opened or closed.—ALEXANDER GRABAU.



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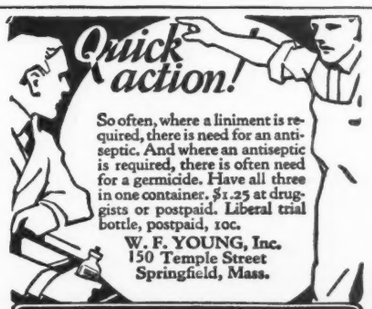

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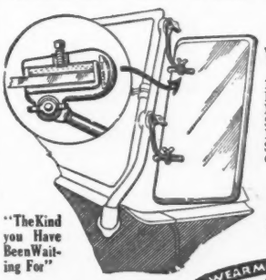
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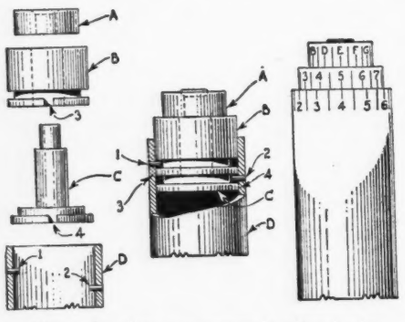
THE HOME WORKSHOP

Homemade Combination Locks Small Desk or Wall Safe

THIS simple combination lock is one I made for a small wall safe for the safe keeping of stamps, coins and jewelry, although obviously it could be used for other purposes.

The lock proper consists of only three parts, *A*, *B*, and *C*. Part *B* fits over *C* and *A* fits on top of *B*. Part *B* must turn freely



When the slots are correctly alined, the door opens

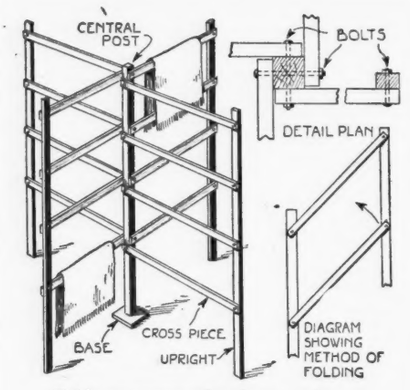
after *A* is riveted to *C*. The slots 3 and 4 must be in line with the pins 1 and 2 before the lock can be opened.

After placing the slots in correct alinement, pull on the lock until pin 1 enters the groove occupied by pin 2. Then turn *C* until slot 4 comes in line with pin 1. The lock will then pull out. It is necessary to mark off dials as shown on all the three parts.—JOHN AURES.

Clothes Horse Quickly Made

MANY are the days that washings cannot be hung out of doors, yet the drying of clothes indoors is always a problem. Some use lines, some driers that can be bought; we have tried both, but my wife likes this homemade clothes horse best of all. It takes up little room when not in use and yet holds a number of clothes.

White pine, cypress, or any light wood that does not warp easily, can be used. For the central post one piece 2 by 2 in. by



Folds up compactly when not in use

6 ft. is required; for the four other uprights, 1 by 1½ in. by 6 ft. pieces. Sixteen ¾ in. by 1 in. by 28 in. rods are needed for cross pieces and one ⅞ by 8 by 8 in. for the base. To fasten the parts together use 16 bolts ¼ in. by 2¼ in. and 8 bolts ¼ in. by 4½ in.

The wood should be sandpapered so there will be no rough places. It can be white enameled or left without finish.—K. W. F.

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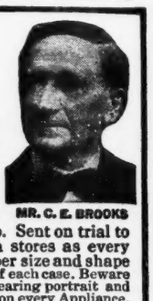

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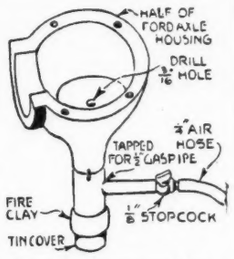
THE HOME WORKSHOP

Ford Axle Housing Forms a Cheap Portable Forge

ONE half of an old Ford axle housing, which can be obtained at little cost from an automobile junk dealer, can be used for building a small portable forge that will serve many uses in the home workshop, garage, or small machine shop.

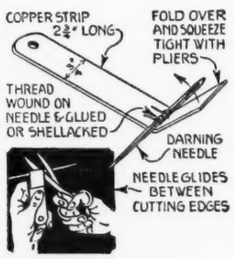


For the home smithy

The housing is cut off so as not to be of unwieldy length, and fire clay and tin are used to stop up the ends. Air is supplied through a length of ½-in. pipe, to receive which the housing is tapped. The bellshaped firebox of the forge is provided with a circular iron bottom, in which is drilled a 3/16-in. hole to admit the air.—G. F.

Sharpening Shears with a Needle

THE sharpener for shears illustrated below was made with nothing more than a small piece of sheet copper, a darning needle, some thread, and a drop of shellac.

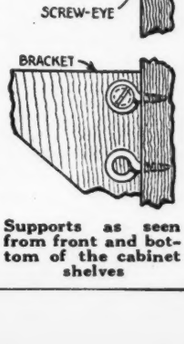

COPPER STRIP 2¾" LONG
FOLD OVER AND SQUEEZE TIGHT WITH PLIERS
THREAD WOUND ON NEEDLE & GLUED OR SHELLACKED
DARNING NEEDLE
NEEDLE GLIDES BETWEEN CUTTING EDGES
How the sharpener is made and used

The copper, ¾ by 2¾ in., was bent up ½ in. from one end. The thread was wrapped around the middle of the needle, which was placed in the bend and fastened with a touch of shellac. The copper was then bent entirely over and clamped tightly with pliers. The extreme point of the needle was ground or broken off to prevent pricking the hand or fingers.

To use, place either end of the needle between the cutting edges of the shears and close the shears, allowing the needle to slide smoothly between the edges. Repeat the operation several times until a good edge is obtained.—JOHN A. GESSLER.

Screw-Eyes as Shelf Supports in Music Cabinet

ONE of my students who was making a music cabinet found that none of the local hardware stores had regular shelf supports in stock. I therefore suggested putting in the three shelves with screw-eyes. Three were placed on each side of each shelf. Since the shelves were extra wide and gave signs of warping, a screw was screwed through each screw-eye into the under side of the shelf. These substitute supports cost little, served the purpose well, and looked neat.—G. C.



Supports as seen from front and bottom of the cabinet shelves

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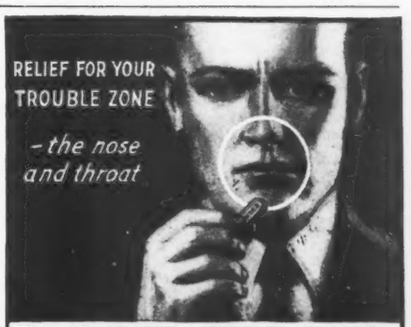

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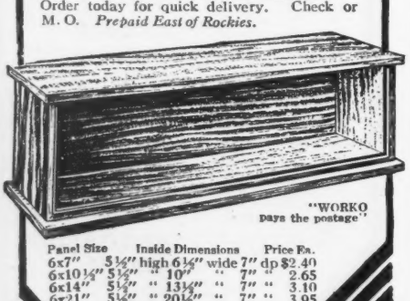

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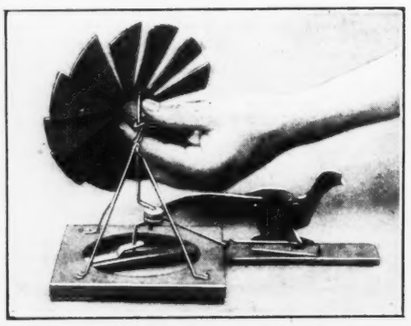
Hot-Air Propeller Operates Novel Pecking Bird

THE mechanism of this little novelty consists of two parts, a pecking bird and a propeller driven by hot air from any radiator or stove.

The base is ¼ in. thick and 6 in. square, with a round hole in the center 4 in. in diameter. The bird is cut from a printed picture and mounted on cardboard, or is drawn directly on cardboard. It should have three separate parts, body, neck, and tail. The body is mounted on a stationary piece of wood, while the tail and the neck are fastened to the body with string or wire. A little above both points of attachment a thread is fastened so that the head and the tail are held in their normal positions. The neck part must be cut so that it extends towards the base or a separate arm attached to it to provide a long leverage.



When the wheel turns, the bird pecks

Over the round hole a three-legged wire support is made for the wheelshaft, which is a stout piece of wire 6 in. long. Near the bottom a U-shaped bend is formed, and the top is flattened.

Place the shaft through the loop of the tripod support, hold it vertically, and attach a thin piece of wood over the round hole, directly below the shaft. A small step bearing should then be provided as shown.

Cut off two pieces of wire about 2 in. long, form a loop at each end, and fasten them together. One end is placed in the U-shaped bend, between two thin corks; the other end is attached to the long lever-like arm on the neck of the bird. When the shaft is turned, the bird will bob its head as if it were eating, and whenever the head goes down the tail goes up.

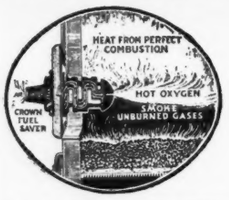
The wheel is made from thin tin, 6 in. in diameter, attached to the top of the wire shaft by means of a cork.—F. H. L.

Uses for Shotgun Shells

EMPTY shotgun shells should not be thrown away, because they are most useful as containers for small articles. They can be corked like bottles and stored away compactly in drawers or boxes.

The home worker can arrange a rack for the shells in which to keep small screws, drills, taps, and reamers. The sportsman can use the shells to hold hooks, splitshot, sinkers, and other small items of equipment. The autoist can carry them in the side pocket of his car to keep fuses, contact points, springs, cotters, and lock washers separated and properly labeled for immediate use. An emergency sewing kit can be made by wrapping a liberal supply of thread around a shell and placing inside it a few buttons, needles and pins.—J. V. R.

The COAL shortage is your opportunity



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Type 166 charges 6 Volt Battery At 12 amps $24
Type 1612 charges 12 Volt Battery At 7 amps $24
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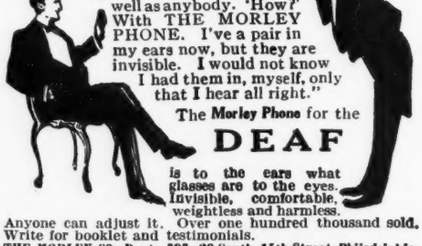

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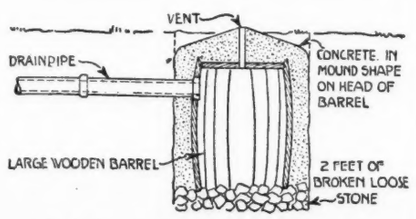
THE HOME WORKSHOP

A Barrel Form Used in Making a Concrete Cesspool

A CESSPOOL for sewage disposal may be built with little more than two bags of cement and a large wooden barrel. A hole about 6 ft. deep is dug in the ground and then filled in loosely with rock and brick for a depth of 2 ft. The barrel is cut out at the place where the drain is to enter and is placed in an inverted position on the loose rock. A mixture of cement and sand



The barrel is set on broken stone foundation and concrete poured around it

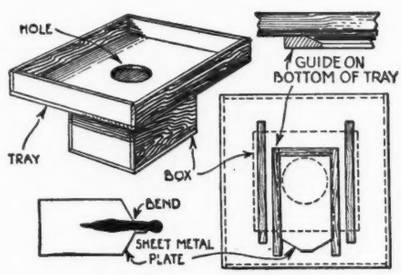
is then poured between the barrel and the surrounding wall of earth.

At the top of the barrel a 2-in. hole is fitted with a tin tube before the cement mixture is built up in mound shape over the barrel. This vent prevents any accumulation of gas from backing up the pipe. Eventually the barrel will rot away but the concrete walls will remain permanently.—G. A. LUERS.

Tray for Sorting Small Parts

THIS tray will save much time in sorting the usual miscellaneous lot of nuts, bolts, screws, washers, and other small parts and fittings kept together in boxes or tins in the home workshop.

Place the sliding plate under the hole, dump the "junk" into the tray, spread out



This device makes it easy to find the right nut, screw, and washer without any delay

the parts, and you will be able to find what you are looking for in no time.

To put everything into the box again, set the tray on top of the box, pull out the plate and use it to scrape the scattered parts through the hole.—D. W. CLARK.

"Shielding" Your Radio Set

SOMETIMES when adjusting the knobs and dials of sensitive, closely regulated outfits the signals will die down as soon as the hand is removed. This is due to the capacity effect of the body. To get around it, cover the back side of the panel with tin foil or sheet copper, using care to see that the metal does not touch contacts, rods or wires. This is called a shield. At the point nearest the ground, connect the shield with the ground.—W. J. T.

"Radio—the New Field of Unlimited Opportunity."

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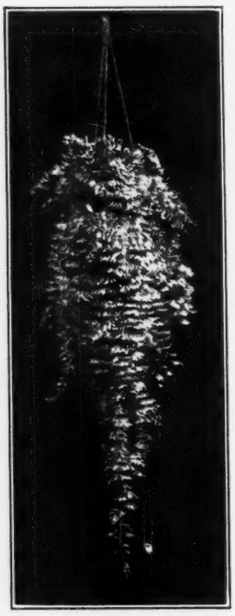
THE HOME WORKSHOP

How to Make Permanent Baskets of Sea Moss

DAINTY basket plants resembling fluffy tropical vegetation may be made by placing "sea moss" in a large snail shell. This so-called sea moss is not related to the vegetable kingdom, but is a colony of animals, the hydroid polyps, scientifically known as *Hydroidea*. These usually are tiny creatures which, through budding, have developed numerous branches, and, according to their spec es, they produce tiny tree-shaped, bush-shaped, or delicate mosslike structures.

All of the animals in the colony are connected with each other by means of a canal. In this way the food that one polyp may catch is distributed through the colony. The outer surfaces of these tiny animals excrete a chitinlike substance that often completely surrounds the stem and branches.



One of many basket shapes

Sertularia argentea, which is the polyp used for the "plant" in the hanging garden, occurs in large stocks producing many-branched feathery projections on which the individual, sessile animals are found. These bunches form thick clusters on the shallower places along the beaches and can be found at almost any season of the year. All that need be done is to color them slightly and place them in some suitable container. These "plants" require absolutely no care whatever; when once suspended they will keep "fresh" for years.—E. B.

Old Vacuum Cleaner Serves as Suction Fan for Small Shop

A SUCTION fan, for use in connection with a grinder and buffer, may be constructed from an old vacuum cleaner. One of these may be obtained usually from any firm dealing in vacuum cleaners, since they take old ones in part payment for new cleaners and, as the old ones are antiquated and of little value for the work they were intended to do, they often can be had for $10 or $12, which is about the value of the small second-hand motor they contain.

Applied to emery wheel

They can be applied to the grinder or buffer by making a suitable hood of galvanized iron and connecting it with the vacuum nozzle. Place the vacuum cleaner slightly lower than the grinder, so that gravity will assist in carrying away the heavier particles.—HARRY J. MORRIS.

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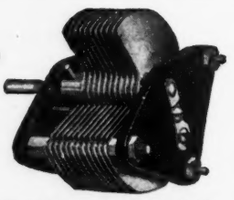

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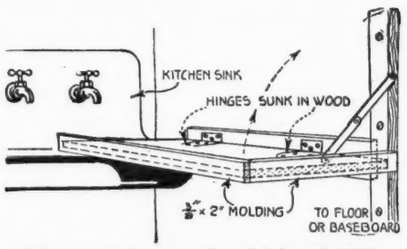
THE HOME WORKSHOP

Hinged Dripboard Provides Extra Space at Kitchen Sink

TO PROVIDE additional working space at the kitchen sink, I constructed a hinged dripboard as shown. The board was a piece of ⅞ by 15 by 28 in. dressed California pine, to which were attached strips of ⅜ by 2 in. molding. The seams were calked on the inside with a mixture of litharge and enough distilled linseed oil to make a putty. After this paste had "set" for about a week, it became as hard as the board itself and thoroughly waterproof.

To mount the board, a strip ⅞ by 5 by 24 in. was fastened against the wall horizontally and another strip ⅞ by 5 in. by 5 ft. was placed vertically at one end of the first strip.



When not in use, the dripboard folds back against the wall

These were screwed to the wall after it had been tapped and plugged.

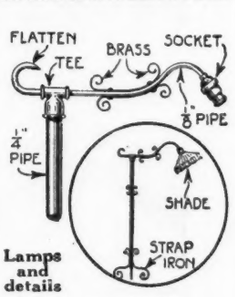
Two light steel 4-in. tee hinges were then used for hingeing the board to the horizontal strip in such a way that it inclined at an angle of 3 degrees toward the sink, the lower end projecting 2 in. past the rim of the sink. A stay for holding the board in position was made from two pieces of strap iron 1/16 by ⅞ by 6 in. I joined them by boring ¼-in. holes and making a rivet from a 5/16-in. length of wire cut from a 20-penny nail.

The board, when folded back against the wall, is fastened with a hook and eye. The entire material cost me $1.37 and proved an investment that was appreciated by the entire household.—WILLIAM H. DECK.

Gaspipe Forms Ornamental Reading or Piano Lamp

OLD gaspipe and a little strap iron and brass can be worked up into a practical and good looking reading or piano lamp at a cost of next to nothing.

The stand should be of either ⅜- or ½-in. pipe. On top of the stand is screwed a tee, reducing to ⅛ in. The arm is bent from ⅛-in. pipe and on one end of it is screwed an electric socket and shade holder. The ornaments are formed from strips of brass soldered or riveted to the arm; similar ornaments are attached to the stand. The feet are made from strap iron and attached to the pipe with stove bolts screwed into tapped holes in the pipe.



Lamps and details

The lamp should be finished in dark bronze and the arms touched with gilt in polychrome effect. A suitable shade frame can be purchased.—PAUL W. TRIER.

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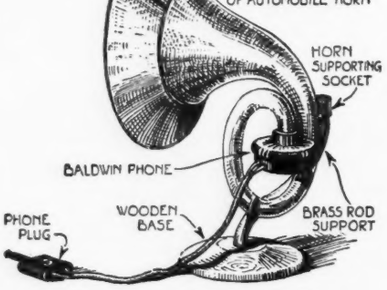
Auto and Phonograph Horns Combined in Loudspeaker

By John A. Mahon

A LOUDSPEAKER I made for myself out of an old auto horn and a portion of a phonograph horn has given exceptional satisfaction. The volume of sound it produces easily fills a whole apartment, and it is absolutely devoid of rasping, mechanical noises. I compared it in respect to clearness, absence of distortion and appearance with five different kinds selling for $45 and less and would not exchange it for any one of them.

To make one like it, obtain from a junk dealer one of the oldtime auto horns with a 4-in. bell, if possible. The larger the bell, the better. Remove the flexible tubing that joined the bulb to the horn and with it



This makes an attractive looking as well as efficient amplifier

the reed of the horn. Then get an old tin phonograph horn with a brass bell that will fit the outer rim of the auto horn. Remove the bell from the phonograph horn and solder it to the bell of the auto horn, as shown.

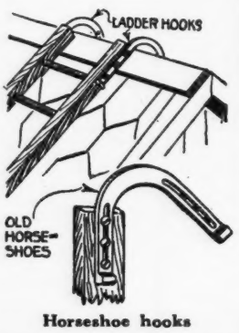
Bend a piece of brass rod so that one end will fit in the socket of the auto horn where it was fastened to the auto, and insert the other end of the rod in a wooden base, which should be well weighted. Glue a piece of felt to the bottom of the stand.

I found that a Baldwin C phone exactly fitted the end of the horn where the reed had been removed. Other phones can be connected by means of a piece of rubber hose slipped over the phone and held to the horn by a rubber band or fastened with a metal clip soldered to the horn.

Polish up the old horn, give the base and body of the horn back of the bell a coat of black enamel, and you will have a dependable and satisfactory loudspeaker. The whole outfit, including horn and phone, should not cost more than $8 or $10.

Ladder Hooks for Roofing Work

IN ORDER to use a short ladder in making roof repairs, a mechanic made two hooks simply by nailing horseshoes to the upper ends of the ladder and bending the irons open. These hook over the ridge of the roof and hold the ladder securely.—S. L. D.



Horseshoe hooks

The Mark of the Quality Radio Store—

WHEN you see this sign on the clean plateglass window of a radio shop *you may enter*—assured that the apparatus and prices are right; the stock complete; a competent radio expert in charge—and the Golden Rule in force.

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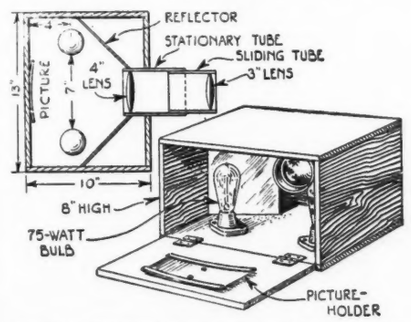
THE HOME WORKSHOP

Making a Projector for Picture Postal Cards and Photos

By Harry L. Gray

A POSTAL-CARD projector will provide an unlimited source of evening entertainment. The construction of the apparatus is not difficult if electric current is available. Two bulbs, preferably 75-watt, will be needed, as well as two reading-glasses. These can be 3 and 4 in. or 4 and 5 in. in diameter. The larger glasses will give a much brighter image on the screen.

A box to contain the bulbs, lenses and reflectors can be made of wood or metal. The dimensions indicated on the drawing will prove about right, but they can be varied somewhat to suit the material on hand. Hinged at the bottom, the back



The projector with door open, and view showing location of lights, reflectors, and lenses

opens downward to make easy the changing of the pictures. The postal-card holder should be slightly curved for best results, as that allows all parts of the picture to be brought into focus at once.

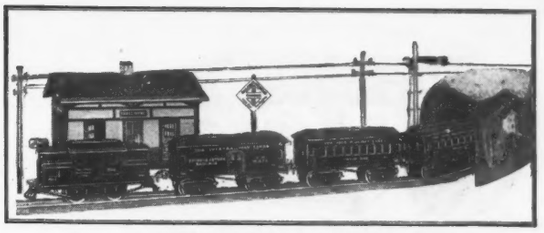
A reflector is placed in each forward corner of the box; these can be of bright tin or tin, enameled white. The interior of the box should be enameled white with the exception of the back and the lens tubes, which should be black. The lens tubes can be made of metal or cardboard, or sometimes two cans may be found that will slide within each other. One of the glasses is fastened in the end of each tube, the larger glass being placed to the rear. After the apparatus has once been focused, the tube with the large lens is fastened solidly in place and the smaller tube used for all further focusing.

In case electric current is not to be had, the constructor can use acetylene. Simply place a burner in the positions of the light bulbs, and use a tank or small acetylene generator.

Any kind of pictures may be shown, but they will be reversed on the screen. This is not, however, objectionable, unless there is lettering on them, in which event the pictures should be viewed from the back of the screen.

To Remove a Broken Ax Handle

A GOOD way to remove a broken ax handle from the eye of the blade is to saw off the wood even with the blade and drill a hole through the piece that remains incased within the steel. Next, make four cuts with a hacksaw, quartering the wood so that the four pieces can be driven out easily.—W. M. SCHMIDT.



SPECIAL $15 COMBINATION

The Ives Electric Train Outfit, 31 inches long, consisting of reversible locomotive with electric headlight, 3 cars with automatic couplers. 14 feet of track, station, tunnel, semaphore, danger signal and 6 telegraph poles. If your dealer can not supply you send us the money and we will see that you are taken care of.

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AN IVES Railroad System will make any boy smile. They range from $1.75 to $50.00 in price. There are spring locomotives that whiz around an "O" gauge track and monster electrics that operate on standard 2 gauge track, exact copies of the latest New York Central models.

The Ives Railroad Systems have a dazzling variety of bridges, tunnels, switches, passenger and freight stations, signals and railroad equipment lights. The freight cars are painted like the real ones on principal railroads, coal cars, tank cars, flat cars, lumber cars, cabooses.

The Ives Trains can be operated either indoors or out. After the indoor season their substantial construction makes them an ideal outdoor toy. Boys can build a railroad, running a spur track to the edge of a pond or brook, ship the freight to a miniature wharf and load it on an Ives merchant ship—an entire transportation scheme all with Ives equipment. No other manufacturer furnishes this complete outfit. It can all be bought in separate units.

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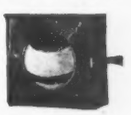

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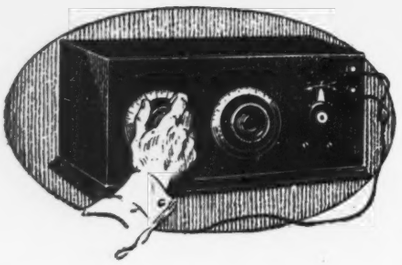

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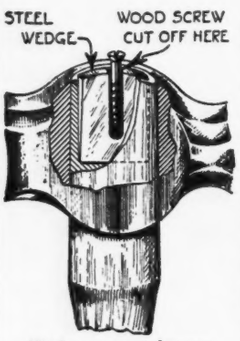
SHEETS TUBES RODS

THE HOME WORKSHOP

Screw Fastens Steel Wedge Permanently in Handle

THE accompanying illustration shows an effective method of permanently securing the wedge in the handle of a carpenter's or machinist's hammer, so that neither jarring nor the shrinking of the wood will cause the handle to come out of the eye of the hammer.



Wedge cannot loosen

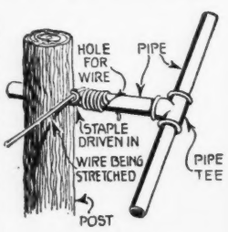
The wedge is made of steel and should be wide enough to reach lengthwise almost across the hammer's eye. In the center of the wedge a hole is drilled with a diameter slightly larger than the thickness of the wedge at its thickest part. Then two parallel saw-cuts are made from the thick end of the wedge to the hole, so as to form a slot with rounded bottom.

The wedge is driven into the handle as shown in the picture and a wood-screw is screwed into the slot until its point is stopped by the rounded bottom of the slot. The projecting portion of the screw is then sawed off and filed smooth.—R. H. Y.

Hand Twister for Stretching Wire

STRETCHING fence wire is an easy matter with a tool such as is illustrated, which is simply a tee made of short lengths of 1-in. pipe.

This tool is used by a Maryland farmer for practically all his fence work. The end of the wire to be stretched is passed through a staple to guide it and into a small hole in the stem of the tee, then being twisted about the pipe.

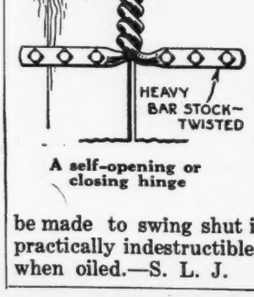


A useful one-man tool

After the wire is tight, the staple is driven entirely in to hold it.—G. A.

Strong Hinges for Garage Doors

THIS simple form of hinge was made especially for hanging a heavy garage door. It was forged by heating two lengths of bar stock, and twisting them around each other. The ends were then flattened and drilled for bolts.



A self-opening or closing hinge

The construction is such that the weight of the door causes it to swing open when unlocked. By twisting the rods in the reverse direction the hinge could be made to swing shut if desired. It is practically indestructible and works easily when oiled.—S. L. J.

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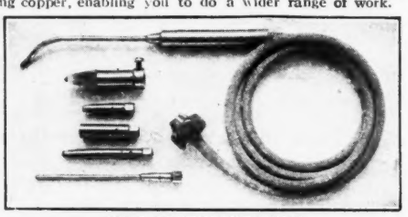

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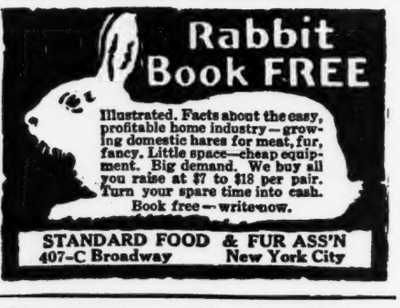
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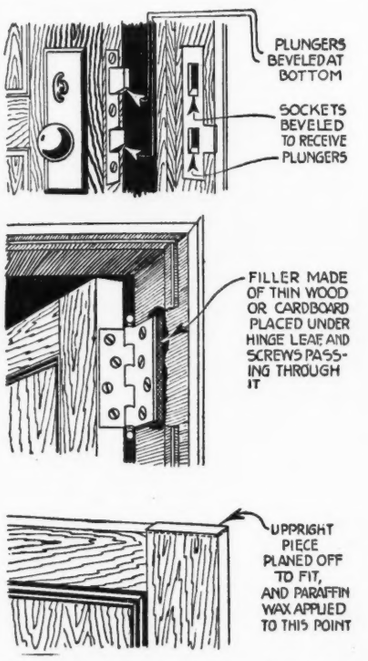
The Shipshape Home

How to Do the Odd Jobs

Fixing That Balky Door

QUITE often there will be a door in the house that is a "lame duck." You try to close it and it will not close tightly; you try to open it and it sticks; and when your back is turned, it seems to swing open of its own accord. When you try to latch it, the plunger seems either too short to reach the striking plate or will not enter it. And it is quite probable that the hinges creak, too.

Let's perform an "operation" on the door. Pull the pins from the hinges, or, if


PLUNGERS BEVELED AT BOTTOM
SOCKETS BEVELED TO RECEIVE PLUNGERS
FILLER MADE OF THIN WOOD OR CARDBOARD PLACED UNDER HINGE LEAF AND SCREWS PASSING THROUGH IT
UPPRIGHT PIECE PLANED OFF TO FIT, AND PARAFFIN WAX APPLIED TO THIS POINT

Three suggestions for altering doors that do not close easily

necessary, remove the screws from one leaf of each hinge, and take down the door. Dress off the part at the top or the bottom that would not permit it to close. If much wood is to be removed, it is best to saw it, but in most instances you will find that the work is easier done with a hand plane, rasp, or even coarse sandpaper. Do not varnish the raw edge, but rub on paraffin wax, cover with paper, and pass a moderately warm iron over it several times.

To make the lock catch, place pads cut from fiber board, pasteboard, or thin wood between the hinges and the door-jamb. Oil the hinges and pins and rehang the door. If the bolt still refuses to enter the striking plate, file the top or bottom of the plunger to a bevel, and if that is not sufficient, bevel also the top or bottom of the socket into which it is to fit.—LEROY CRIGLER.

Connecting Lead Pipes

THE household mechanic has a good deal of difficulty in connecting lead piping by means of the conventional "wiped" joint, particularly when the splice is to be made in some inaccessible place. The following method requires little skill and completely eliminates any danger

(*Continued on page 126*)

Radio

The Greatest Radio Offer of the Year—Absolutely Complete, $49.50

This special receiving outfit will give as good results as any outfit of this improved type on the market. It is absolutely complete, there is nothing extra to buy. We include everything—you simply put up the aerial, connect the instruments, which is easy to do, and in less than half an hour you can be receiving signals, radio music, lectures, stock reports, market reports, or any other radio program sent out.

In making tests with this set in Chicago we regularly heard Detroit, Pittsburgh and other stations were often tuned in. Of course, atmospheric conditions affect the range of this or any other receiving set made.

Highest Development in Radio Receiving

This outfit will equal in results any outfit of this type regardless of price. It is especially made for us and has behind it the fifty year old guarantee of Montgomery Ward & Co.: "Satisfaction guaranteed or your money back." You take no risk whatever in ordering this set.

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The complete outfit includes our special Combined Tuner and Detector; Special 2000 ohm Double Head Set; Radio Storage Battery; one Detector Tube, one "B" Battery; and complete antenna and connecting equipment including 150 feet bare copper wire and 25 feet insulated wire, porcelain tube; double throw switch; 2 antenna insulators; lightning protector; ground clamp, 2 screw eyes and 25 feet of wire for instrument connections.

Order this set at our risk. It will be packed carefully and shipped immediately from our nearest house. Shipping weight 40 pounds.

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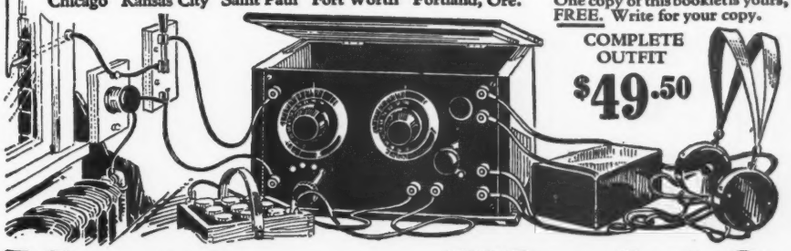

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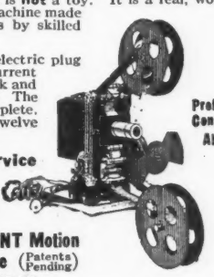

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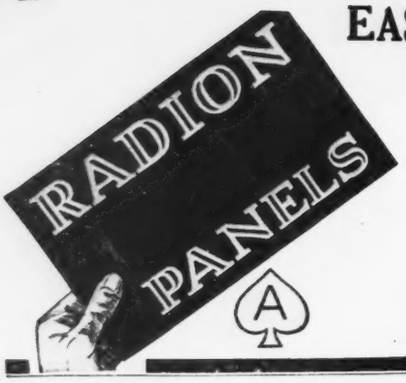

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THE HOME WORKSHOP

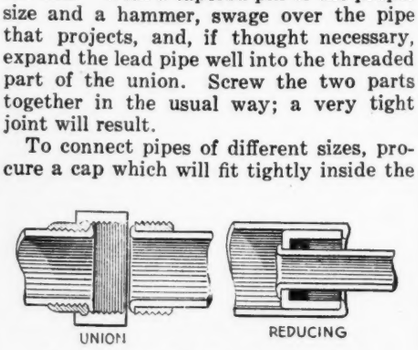
The Shipshape Home

(*Continued from page 125*)

to property or fingers from the melted lead.

To connect pipes of the same diameter, secure a union of the proper size and screw each part separately to each end of the pipe, running through about ¼ in. beyond the end. With a tapered pin of the proper size and a hammer, swage over the pipe that projects, and, if thought necessary, expand the lead pipe well into the threaded part of the union. Screw the two parts together in the usual way; a very tight joint will result.

To connect pipes of different sizes, procure a cap which will fit tightly inside the



Two easily made joints for lead pipes

larger pipe and drill a hole of the size of the smaller pipe in the end. Push the end of the smaller pipe through the cap and through the drilled hole so that it projects about ½ in. Swage over this part and pour enough melted lead into the inside of the cap to have a layer ½ in. thick. The lead pipe should be scraped to let the lead take hold. The cap is then driven into the larger pipe so that ¾ in. projects, and this is turned over into the cap, if possible. The pipe should also be hammered down to fit the cap closely.—MYRON DRACHMAN.

Bolting into Cement

A THREADED hole may be made in cement very easily whenever it is necessary to bolt a table, bench, or machine to a concrete floor, or to fix brackets to concrete walls or ceilings. Drill holes in the concrete somewhat larger than the bolt and then wind the thread of each bolt with wire, the diameter of which is about equal to the pitch of the thread. Place the wire and bolt in the hole and pour cement around them. In hardening, the cement will hold the wire thread firmly so that the bolt can be screwed in or out with very little difficulty.—HAROLD F. BLANCHARD.

Cementing Celluloid

WHEN film cement cannot be obtained for cementing celluloid and mending broken celluloid articles, the following preparation may be used instead:

In 1 oz. of acetone dissolve about 8 sq. in. of celluloid or old photographic film that has had the emulsion washed off. Paint a thick coat of this solution over both sides of the break and press or clamp the broken parts together. Small strips of the washed film can be cemented over the break with the same solution, if it is desired to strengthen the joints further.

Acetone, which may be obtained at any drug store, is the natural solvent for celluloid.

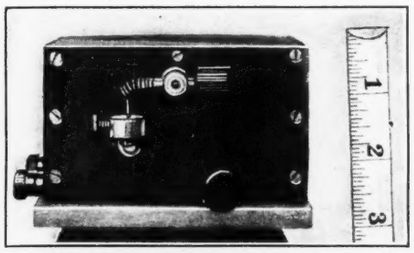
In addition to using this solution of celluloid in acetone for repairing cellulcid articles, it can be coated over brush brass and nickel-plated ware and even over plain wooden articles to preserve or enhance their original finish.—F. ST. BOULANGER.

THE HOME WORKSHOP

Miniature Radio Cabinet Has Slide Tuning Coil

A MINIATURE radio receiving set of the loose coupler type was under construction in which the primary coil was 4 in. long and 1⅝ in. in diameter, wound with No. 28 wire. It was to be mounted in a little cabinet. Close tuning was desired, involving the taking off of a considerable number of taps. In such a small outfit this meant a lot of time, and time was limited. The same result was accomplished by using a slide tuning device.

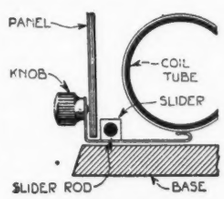
The coil was fastened in the cabinet with the scraped contact path for the slider underneath, so that particles of metal worn off would fall away from the wire and not lodge between the turns and short circuit them. To an ordinary slider, from which



A sliding lower knob regulates wave length of this tiny crystal receiving set

the usual contact finger was removed, a brass plate was soldered, as shown. This was of thin spring brass. One end was cut down to form a flexible tongue and bent to make contact with the coil at the proper place, and the other end was bent so that it was vertical when in place.

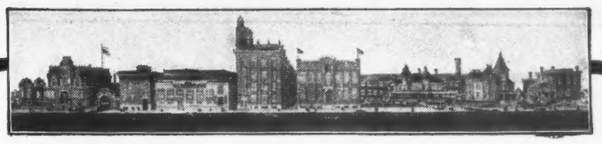
The rod for the slider was placed close to the bottom of the cabinet, near the front. The composition panel, ⅛ in. thick, did not reach quite down to the base, so that there was a slit about 1/16 in. wide through which the slider plate projected. The bent part of the plate was parallel with and not quite touching the panel. To it a black composition knob was secured. This was quite a little job in itself. A brass screw was turned tightly into the socket of the knob and then cut off so that it projected only a trifle more than the thickness of the brass plate. The screw was passed through a hole in the plate, soldered and filed flush.



Section through slider

The slider was guided in its movement by the lower edge of the panel and the wooden base. The rod used was tubular, cut exactly to the length of the inside of the cabinet, and the ends tapped for machine screws. One end was held by a machine screw with the head countersunk in the wood, and the other by the screw of a binding-post for the ground lead.

A small crystal detector made up of a cup mounted on a nickeled angle plate, a rod with a catwhisker on one end and a binding-post knob on the other, and a binding-post through which the rod passed, were mounted on the panel. In all other respects the set is just an ordinary loose coupler on a small scale. The secondary is wound with No. 32 wire. Under favorable conditions, the set will bring in broadcasting over a distance of 25 miles.—HOWARD GREENE.



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